



Phytomedicinal Potential of “*Dimocarpus Longan Lour.*” as an Essential Nutraceutical

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ABSTRACT: For many centuries Longan (*Dimocarpus longan* Lour.) a native plant of Northeastern India, and Southeast Asia has been used for its nutraceutical properties. The phytochemicals constituents include carbohydrates, proteins, polysaccharides, vitamin C, polyphenols, that exhibit innumerable biological properties. It is essential to review the immunomodulatory, antioxidant, and phytomedicinal potential with the aim to provide a comprehensive information for future development of longan as an essential nutraceutical. Longan is in great demand as various food products viz dried pulp, frozen, fresh, and processed as jam, drinks, wine and canned fruit. The key biological activities of longan pericarp are tyrosinase inhibitory, antioxidant, anti-inflammatory, immunomodulatory, anti-glycated, anti-cancer, memory-increasing impact, and other parameters that have a significant contribution to human health.

KEYWORDS: Antioxidants, bioactivities, *Dimocarpus longan*, flavonoids, polysaccharides, polyphenols.

INTRODUCTION

Plants are used as natural resources for many drugs for human ailments since time immemorial. The consumption of plant products reduce the problem of cardiovascular diseases, cancer and diabetes etc. There are many native plants which are rich in bioactive compounds but are not very popular or commercially cultivated. Longan (*Dimocarpus longan* Lour.) is an arilloid fruit tree belonging to Sapindaceae family (Fig 1). In terms of area of production it is the second most popular tree species of family sapindaceae, the first being is the popular lychee/litchi. The botanical synonyms are *Euphoria longan* Steud., *Euphoria longana* Lam., and *Nephelium longana* Cambess. It is also referred as the “little brother of lychee” or “Dragon’s eye” or “Eyeball” [1]. There are six species, one being *Dimocarpus longans*, and other five are *Dimocarpus gardneri*, *Dimocarpus dentatus*, *Dimocarpus foveolatus* and *Dimocarpus fumatus* growing in the Asian continent from India to eastern Malaysia and one (*Dimocarpus australianus*) grows in Australia. Longan was planted as an edible fruit and was mentioned in *Materia medica* as a “tonic” or the “king of fruits”. Longan fruits can be eaten as fresh, frozen canned or dried form. Longan fruit is grown commercially in many countries like India, China, Vietnam, Thailand, etc. In China, the import of longan fruit has been increasing and the market demand is for varied types such as dried, fresh, processed and frozen. The fruit pulp was used as traditional Chinese medicine to enhance blood metabolism, relax nerves and neural pain, prevent insomnia, amnesia and enhance longevity [2]. The dried arils of longan are also used for making refreshing drinks due to its smoky flavor. In addition, the dried aril are also used as herbal medicine for insomnia, antidote of poison and stomach ache [3]. The fresh fruits have very short shelf life and fruit rapidly deteriorates due to pericarp browning caused by oxidation of phenolic compounds by the action of enzymes peroxidases, polyphenol oxidase and phenylalanine ammonia lyase. Longan seed extracts also exhibit anti-gelatinase activity [4]. Commonly marketed products of longan fruits are in the form of dried longan pulp, longan juice, longan jelly, longan wine and even canned as syrup [5]. Recent reports suggest the innumerable nutritional and functional components of longan pulp that include carbohydrate, protein, fiber, fat, vitamin C, amino acids, minerals, polyphenols, and volatile compounds [6]. The chemical constituents such as polyphenols and polysaccharides exhibit antioxidant, antiglycation, antityrosinase, potent immunomodulatory, anticancer, memory enhancement, antianxiety activities [7, 8]. Based on the structure of longan, many bioactivities can be termed as nutraceuticals, functional foods, and food additives. This review highlights the potential of longan as nutraceuticals, medicine and other miscellaneous products due to presence of large number of bioactive compounds.



Fig 1: Fruits of *Dimocarpus longans* showing seed and aril

CHEMICAL COMPOSITION OF LONGAN

Alkaloids are the main functional metabolites consist of polysaccharides, carotenoids, and flavonoids. The seed and pericarp are rich in many bioactive compounds. Twelve important compounds of longan are β -sitosterol, 2-methyl-1,10-undecanediol, 2-phenylethanol, Nicotinic acid, (24R)-6 β -hydroxy-24-ethyl-cholest-4-en-3-one, Oleanolic acid, 4-hydroxybenzoic acid, Pinoresinol, Uracil, β -daucosterol, Adenosine and 1-O-methyl-D-myo-inositol. Longan has many important polyphenolic compounds such as ellagic acid, corilagin, gallic acid, and geraniin and many flavonoids like Epicatechin, Kaempferol, Quercetin, Proanthocyanidin trimer, Rutin, Isoquercitrin, and Flavogallonic acid [9-14]. In addition, many antioxidants can be extracted viz., quercetin, isovanillin, astragaline, hyperin, scopoletin, β -phenylethyl alcohol, and piperine [15-17]. The most significant antioxidant constituent extracted from longan shells are isovanillin, quercetin, scopoletin, astragaline, β -phenylethyl alcohol and hyperin. The intense aroma of the longan fruit due to volatile component in the fruit. The flesh fruit is juicy, low in acid, and high in sugar. Longan consists of several minerals and vitamins, including iron, phosphorus, magnesium, potassium, and vitamins C and A.

POTENTIAL AS NUTRACEUTICALS

Nutraceuticals play a detrimental role as supplements in non-communicable diseases and to maintain a healthy lifestyle and for anti-aging. Most of these nutraceuticals are antioxidants agents, anti-inflammatory, anti-carcinogenic and anti-angiogenic agents. In addition, nutraceuticals have the potential, to reverse brain disorders, DNA damage, protein aggregation and promote healthy aging prevent onset of dementia. The main constituents are carbohydrates (12-23%) which is active in immunological responses as well as probiotic and antioxidant properties. Nearly, 28 different free amino acids have been identified out of which eight are essential amino acids, the most abundant are phenylalanine, alanine and glutamic acid. The pulp is also rich source of potassium required for proper functioning of nerves and muscles. Minerals such as iron (Fe), calcium (Ca), phosphorus (P), and magnesium (Mg) and vitamins such as Vit C (ascorbic acid), riboflavin, thiamin, and niacin are present in the fruit pulp of all varieties of longan [18-19]. Longan fruit is enriched with some organic acids and ethanol-soluble sugar fraction that stimulates growth of bacteria such as *Streptococcus thermophile*, *Lactobacillus acidophilus*, and *Lactobacillus delbrueckii* thus attributing additional property for developing effective nutraceuticals and functional foods. The longan fruit is normally eaten fresh like litchi and the taste is similar to/or superior to litchi.



Table 1: The main bioactive compound present in 100 gm of pulp of Langan fruit (Adapted from USDA National Nutrient Database).

Bioactive compound	Quantity
Carbohydrates	15.14 gm
Protein	1.31 gm
Potassium	266 mg
Ascorbic acid	43.12–163.7 mg
Fe	0.13mg
Calcium	1mg
Phosphorous	21mg
Magnesium	10mg
Vitamin C	84mg
Thiamin	0.031mg
Niacin	0.3mg
Riboflavin	0.14 mg
Water	82.75 gm

MEDICINAL PROPERTIES

In traditional Chinese medicine, longan fruits are considered to have warm, sweet, and astringent properties. Nearly, all parts of the plant are used as medicine such fresh fruits and dried fruits are used to relieve anxiety. Leaf extract, flower and seeds are an equable system, and help in kidney functioning. The roots are used for treating diabetes and gonorrhoea. The most important health benefits of longan are for skin care, anti-anxiety, anti-aging, blood tonic, boosts libido, insomnia, weight loss, and blood pressure, strengthens immunity, protect brain, aids in digestion, prevents chronic diseases, eyes health and boosts memory. This clearly demonstrates the potential of longan as a super fruit and its extract made from various parts can serve well as a supplement in food and pharmaceutical industries.

Longans in traditional medicine is used to relieve mental fatigue and calm the spirit while the dried pulp has immunomodulatory function. Longan seeds and flowers are used for relieving pain and urinary diseases due to its rich antioxidants and polyphenolic content, making it attractive for the treatment of cancer and diabetes. The flower extract too is rich in antioxidants and is able to cure inflammation, metabolic disorders [20]. Liu et al observed that leaves and barks are excellent sources of inhibitor of free-radicals produced due to various metabolic reactions [21]. The gallic acid has antioxidant effect and also have cytotoxic effect on cancer cells [22]. The other pharmacological properties such as antiglycated, antityrosinase, anticancer and antifungal has also been observed [23]. It has strong analgesic and central nervous system depressant activity [24, 25]. The aqueous extract of leaves could suppress the kidney calculi [26]. In one of the studies it has been observed that the fruit extract has high anti-osteoporotic activity by inhibiting the osteoclast differentiation and thus can be used for the treatment of osteoporosis [27]. The main metabolites provide anticancer, medicinal, and anti-aging, immunomodulatory advantages to humans. Longan fruit is applied for increasing memory, preventing amnesia, relieving insomnia, and promoting blood metabolism.



Table 2: Various part of the plant with bioactive compound and their bioactivities.

Plant Part	Bioactive compound	Biological activities	References
Aril	Adenosine, Gallic acid, Lysophosphatidylcholine, phosphatidyl choline, phosphatidyl inositol, phosphatidyl serine, phosphatidylethanolamine, phosphatidate and phosphatidic acid glycerol	Stomachic, febrifuge, and vermifuge, and an antidote to poison Enhance learning and memory, Sedative and analgesic effects, DPPH radical-scavenging activity	[29-30]
Pericarp	Flavonoids and polysaccharides	Gallic acid, corilagin, (-)-epicatechin, ellagic acid and its conjugates, flavones, quercetin, glycosides, 4-O-methylgallic acid, flavone glycosides, protocatechuic acid, glycosides of quercetin and kaempferol, brevisfolin	[30-31]
Flower and seed	Proanthocyanidin A2, (-)-epicatechin, gallic acid and ellagic acid	Overcome micturition, urgency and voiding dysfunction	[1, 30, 32]
Seed	Ethyl gallate 1-β-O-galloyl-D-glucopyranose, methyl brevisfolincarboxylate, grevifolinand 4-O-α-L-rhamnopyranosyl-ellagic acid, gallic acid, corilagin and ellagic acid, Ellagitannins, corilagin, acetoxy-geraniin	Antioxidant activity, Treating bleeding, dampness, hernia, lymphomegaly of the neck and armpit, odour, scabies and eczema	[30, 33-34]
Leaves	Quercetin and quercitrin	Anti-mutagenic, anticarcinogenic, antibacterial, cytotoxic and antioxidant effect	[16]

ADDITIONAL PROPERTIES

The seeds are good source of shampoo as it has high content of saponin. Longan leaves are used for dyeing silk fabrics which protect the skin from damaging UV rays. In addition, the pulp, seed and pericarp of the fruit have been used for different disease treatments, such as improving women’s health after childbirth and enhanced immunomodulation. The most important side effect of longan are increased risk of gastrointestinal distress and complications in pregnancy. The fresh fruit is used as vermifuge- antidote for poison, febrifuge and stomach. Red dates along with longan have tremendous potential to modulate the immune system. The pulp polysaccharide-protein complex acts as an effective immunotherapeutic adjuvant [28]. The shell of longan is wonderful biosorbent and can be used to remove cationic dyes from aqueous solution.

CONCLUSION

Longan has the potential of becoming a profitable crop if breeding limitation can be overcome. It is extremely important to create standard protocols for Longan such as pharmacokinetics and pharmacodynamic study of nutraceuticals specifically for impact on human health.

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