Review Article

A brief review on Pharmacological potential of *Nephelium lappaceum* L

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ABSTRACT

Nephelium lappaceum L. belongs to the Sapindaceae family that grows in tropical and subtropical climates commonly known as Rambutan. Rambutan has a long history not only as a delicious and succulent fruit but also as a traditional medicine. The name "rambutan" comes from the Malay-Indonesian word "rambut," which means "hairy." Because of this, it is occasionally referred to as "hairy litchi." The fruit is an ovoid berry that ranges in color from yellow to orange-red, or from brilliant red to maroon. Its leathery skin is completely covered in spinterns of varying lengths. In Asia, where it is commonly consumed fresh, canned, or processed and loved for its reviving flavor and unique appearance, rambutan is a significant commercial crop. Researchers have discovered that rambutan fruit extracts include phytochemicals with antioxidant, antibacterial, antidiabetic, antiviral, anti-inflammatory, anti-cancer, anti-diarrheal, and cardiovascular activity. Rambutan is a superfruit that can be used as a contemporary medicine to treat illnesses and promote good health.

Key words: *Nephelium lappaceum* L., Traditional, Phytochemical, Malay-Indonesian, Health

The fruit known as *Nephelium lappaceum* L. is a member of the Sapindaceae family and is indigenous to tropical areas including Indonesia, China, India, Australia, Malaysia, Mexico, and Thailand. The Malay-Indonesian word rambut, which means "hairy," is the source of the name for the rambutan fruit. N. lappaceum, M. cuspidatum var. eriopetalum, N. jungland-ifolium, N. maingayi, N. meduseum, N. ramboutan-ake, N. melanomiscum, N. reticulatum, and N. uncimatum are among the nine edible rambutan species that make up the Nephelium genus, which has 22 species worldwide [1]. The fruit is an ovoid berry that ranges in color from yellow to orange-red to brilliant red to maroon. The flesh has a sweet to very mild sour flavor and is juicy and translucent white in color [2]. It is a significant commercial crop in Asia and the fruit is valued for its reviving flavor and exotic appearance whether it is eaten fresh, preserved in syrup, or processed [3].

A grayish-brown tree with an evergreen canopy, Nephelium lappaceum L grows to a height of 10 to 12 meters.The components of rambutan include total weight: 27.4%, peel: 13.2%, fruit: 11.7%, seeds: 2.53%, and seed coat: 60%1. The rambutan plant's various parts each have unique advantages and qualities. Additionally, a test for antioxidant capacity found that rambutan fruit has an antioxidant level of 71.5%, which is equal to ascorbic acid [4]. Since ancient times, the plant has been utilized in traditional medicine as a treatment for high blood pressure and diabetes. Additionally, fruits have traditionally been a possible source of minerals and other nutrients [5]. As a result, this article provides an updated assessment of this significant plant with a focus on the traditional usage, phytochemistry, and pharmacological elements that will help researchers in the future find relevant scientific material (Figure 1, Table 1 and Table 2).

Figure 1: Rambutan Fruit

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Vernacular Names [6]

Table 1: Vernacular names of *Nephelium lappaceum* L.

Hindi	Rambutan
Malayalam	Rambuttan
Bengali	Rambutan
Kannada	Rambutan
Telugu	Rambutan
French	Ramboutan
English	Rambutan

Taxonomical Classification [5,7]

Table 2: Taxonomical classification of *Nephelium lappaceum* L.

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Sapindaceae
Genus	*Nephelium* L.
Species	*Naphelium lappaceum* L.

Habitat: A temperature range of 22–300°C and a maximum height of 700 m is deemed suitable for the growth and development of the rambutan in the majority of tropical Asian locales. High rainfall regions with 2,000 to 5,000 mm of rain per year, distributed fairly consistently throughout the year, are typically regarded as appropriate, but supplemental irrigation may be necessary, particularly during the time from flower set to harvesting. Although the rambutan can be grown effectively in a variety of soils, rich, well-drained, sandy loams or clay loams that are rich in organic matter produce the best growth and fruiting. Alluvial soils made of basaltic rocks are the most frequently utilized forms of soil, however, crops grown on red lateritic soils typically succeed when fertilized appropriately using a mix of organic and inorganic fertilizers [8].

Distribution: Over 200 rambutan clones have been chosen for tropical Asia, and Malaysia has the widest variety of farmed and wild rambutan species. Rambutan is grown in Malaysia, Thailand, the Philippines, Northern Australia, Sri Lanka, India, Madagascar, Costa Rica, the Congo, and a few South American nations. The biggest rambutan producers in the world are Thailand, Malaysia, and Indonesia. In Indonesia, Malaysia, Australia, the Philippines, and Hawaii, rambutan farming is growing. In the Indian states of Tamil Nadu, Thrissur, Pathanamthitta, Kottayam, and Ernakulum in Kerala, Nagerkoil, Courtralam, the Nilgiris, Dakshina Kannada and Kodagu in Karnataka, rambutan is grown in household gardens [1,9].

Botanical Description: Evergreen rambutan trees can reach heights of 12 to 20 meters. The 12m tall, grayish-brown branching trees are vegetatively propagated. The lateral roots stay close to the soil surface while the main root penetrates several meters into the ground [5,9].

Leaves: The leaves have 2 to 4 pairs of petiolate, alternating, and pinnate leaflets. The leaflets range in size from 5 to 28 cm and have an ovate to elliptical shape. The rachis maybe 7 to 30 cm long and 3-10 cm wide, with a complete edge, while the petioles are thick and 0.5 to 1 cm long. The inflorescence is upright, has numerous branches, and has numerous blooms [9].

Flowers: Small, 2.5–5 mm, apetalous flowers are produced in upright terminal panicles and are 15–30 cm broad. Rambutan trees can be hermaphrodite, male, or female. Only male flowers, which are apetalous and have 5-7 stamens and a primitive ovary, are produced by the male tree. A panicle can have between 300 and 500 blooms. The hermaphrodite trees produce hermaphrodite flowers with a bifid stigma, a bilocular ovary, and six inactive stamens. There are 500–800 flowers on a panicle. While the female tree only yields female flowers, the hermaphrodite trees also bear 0.5 to 0.8% male blossoms [9].

Fruit: The fruit is a loose pendant cluster of 10–20 round to oval drupes that are 3–8 cm long and 3–4 cm in diameter. Fruits have leathery, reddish, orange, or yellow skin that is coated with fleshy hair. The flesh (aril), which adheres to the seed, is 0.4–0.8 cm thick, transparent, juicy, acidic, subacidic, or sweet [1,9].

Seeds: The seed is 2-3 cm long, oblong, and flattened. Its color is shiny brown. The seed is soft, long to elliptical oval, 20 to 25 mm wide, and between 12 and 22 mm long [9].

Chemical Constituents

A phytochemical investigation carried out on *Nephelium lappaceum* L. epicarp revealed the presence of various phytoconstituents such as carbohydrates, alkaloids, steroids and sterols, glycosides, flavonoids, Triterpenoids, tannins, proteins and amino acids and essential elements in the peel like Mn, Fe, Zn, Mg, K, Na, Ca [10,11,12]. It was determined that the main fatty acids in a Rambutan seed are oleic, arachidonic, palmitic, stearic, gondoic, behenic, and

palmitoleic. The chemical composition of the rambutan fruit pulp is proteins, carbohydrates, calcium, vitamin C, and iron. Rambutan peel has a high content of phenolic compounds and antioxidant activity [11,12]. Ellagic acid, corilagin, and geraniin from the peels and reported for their antioxidant activities. Geraniin is the major constituent that exhibited much greater antioxidant activities [13,14].

Pharmacological Activities

Antioxidant activity: Analyzing the activity of free radical scavengers allows for the measurement of antioxidant capacity. Rambutan peel has similar free radical scavenging properties to geraniin [15]. Geraniin, which constitutes the majority of the peel of the rambutan fruit, is why [16]. Free radicals that might result in oxidative cell damage can be stabilized by antioxidants. The two antioxidant assays that receive the greatest attention are FRAP and the DPPH radical scavenging assay. There are additional reports of other assays such as the lipid peroxidation assay, the galvinoxyl assay, and the beta-carotene bleaching assay [17].

Antimicrobial activity: Peel from a rambutan fruit contains antibacterial properties. Salmonella typhi bacteria are actively inhibited by ethanol extract. The germs Vibrio cholera, Enterococcus faecalis, Staphylococcus epidermidis, and Pseudomonas aeruginosa were all susceptible to the effects of water, ether, and methanol extracts. The bacteria Proteus vulgaricus and Bacillus cereus were then susceptible to the chloroform extract's effects. Compared to the seeds of the rambutan fruit, which only have activity against the microorganisms Escherichia coli, S. aureus, P. aeruginosa, S. subtilis, and Streptococcus pyogenes. The primary phenolic components found in the methanol extract of the Rambutan peel, including geraniin, ellagic acid, quercetin, rutin, and chorilagin, shown inhibitory efficacy against bacteria at various doses and incubation durations [16,18].

Anti-viral activity: Geraniin is the substance that has an impact on DENV-2 inhibition. The researchers concluded that geraniin compounds could prevent DENV-2 from acting by interfering with the virus or by interacting with viral receptors that were important in viral penetration into cells but did not involve cellular receptors. To increase contact with virions, or viral particles, geraniin functions extracellularly. This interaction can lessen DENV-2's ability to spread [19].

Anti-osteoporosis: Retinoic acid was incubated with the osteoporosis/OP rat model in vivo to assess its capacity to inhibit OP using histological, physicochemical, and serum biochemical indicators (serum calcium, phosphorus, alkaline phosphate/ALP, and osteocalcin/OCN). Rambutan peel was bigger than in the model group in the serum calcium and phosphorus of the positive and phenolic groups. Rambutan peel was able to lower ALP and OCN levels by 17.93% and 43.11%, respectively. These findings imply that rambutan peel can enhance retinoic acid-induced OP rats' blood markers of bone metabolism [20].

Anti-inflammatory activity: Rambutan peel's phenolic content has been found to have anti-inflammatory properties. Geraniin, catechins, and ellagic acid are the primary phenolic components that contribute to anti-inflammatory effects. By lowering the synthesis of inflammatory mediators, or through free radicals and metal chelating action, phenolic substances have anti-inflammatory effects [21].

Anti-diabetic activity: In test animals, the presence of flavonoids such tannins, polyphenols, quercetin, catechins, and EGCG can lower blood glucose levels by preventing the absorption of glucose, which in turn stimulates the release of insulin and indirectly overrides the antioxidant process. Geraniin's capacity to stop formation accounts for its ability to lower blood glucose levels [22]. In rats given alloxan, the ethanol extract of rambutan and durian fruit peel can reduce blood glucose levels. Rambutan fruit peels' ethanolic extract contains EGCG, quercetin, and geraniin, all of which demonstrated antihyperglycemia activity [23].

Anti-hypercholesterolemia: Utilizing three different doses, examine the impact of decreasing blood cholesterol on rambutan peel extract. It was discovered that rambutan fruit peel extract significantly reduced blood cholesterol levels in rats, 60.75% more effectively than the positive control. This demonstrates how powerful an anti-hypercholesterolemia with herbal medicinal components the ethanolic extract of rambutan peel is [24].

Anticancer activity: Rambutan peel extract was found to have an antiproliferative impact on the cell lines MDA-MB0231 and MG-63 after 72 hours of incubation. Polyphenol molecules are believed to have anti-cancer properties. According to some substances, biological reactive oxygen species (ROS) can be neutralized. ROS is a type of organism that fights cancer. While ROS can be lowered by either natural or synthetic antioxidants, high ROS reduction can prevent cancer [25].

Antidiarrhoeal activity: When evaluated using a rat model of castor oil-induced diarrhea, the methanol extract of the seeds was found to have considerable antidiarrheal action. When compared to loperamide, the extract showed a substantial suppression of fecal dropping [26].

Cardiovascular activity: According to a study, ethanol extract from rambutan bark had immediate impacts on rats' respiratory and cardiovascular responses. Increases in MABP, systolic blood pressure, and heart rate were seen in the data, which showed a protracted cardiovascular response [27].

CONCLUSION

Nephelium lappaceum L., a member of the sapindaceae family and commonly referred to as "Rambutan," has been utilized for generations in traditional medicine. Fruits have consistently been a possible source of minerals and other nutrients. Numerous phytochemicals, including carbohydrates, alkaloids, steroids and sterols, glycosides, flavonoids, triterpenoids, tannins, proteins, and amino acids, have been found in Nephelium lappaceum L.'s various parts. The pharmacological actions of Nephelium lappaceum L. include antioxidant, antibacterial, antiviral, antiosteoporosis, anti-inflammatory, anti-hyperglycemic, anti-hypercholesterolemic, anticancer, antidiarrheal, and cardiovascular. Every component of the rambutan has medicinal and nutritional value, in addition to having many additional uses.

REFERENCES

1. Shahrajabian MH, Sun W, Khoshkharam M, et al. Rambutan, A Tropical plant with Ethnopharmaceutical properties. Agrociencia. 2020; 54(1): 121-25
2. Mahmood K, Fazilah A, Yang TA, et al. Valorization of rambutan (Nephelium lappaceum) by-products: Food and non-food perspectives. Int Food Res J, 2018; 25(3): 890-902
3. Manaf YNA, Marikkar JMN, Long K, et al. Physicochemical characterisation of the fat from Red-skin Rambutan (*Nephelium lappaceum* L) seed. J Oleo Sci. 2013;62(6):335-43
4. Sholikhah AMN, Muhtadi. Study of Pharmacological Activities and Chemical Content of Rambutan (Nephelium Lappaceum L.) Fruit Peel Extract: A Systematic Review. Atlantis Press, 2022; 251-60
5. Sukmandari NS, Dash GK, Jusof WH, et al. A Review on Nephelium lappaceum L. Res J Pharm Technol, 2017;10(8): 1-7
6. The Free Dictinary.com [Internet]. Rambutan; [cited 2023 May 26]. Available from : https://www.freethesaurus.com/rambutan
7. Hernandez CH, Anguilar CN, Rodriguez-Herrara R, et. al. Rambutan (*Nephelium lappaceum* L.): Nutritional and functional properties. Trends Food Sci Technol, 2019; 85: 201-10
8. Tindall HD. Rambutan cultivation. Rome; Food and Agricultiural Organization of United States: 1994, 15-35
9. Tripathi P, Karunakran G. Fruit Production in India. New Delhi; Narendra Publishing House: 2013, 11-27
10. Monrroy M, Arauz O, Garcia JR. Active Compound Identification in Extracts of N. lappaceum Peel and Evaluation of Antioxidant Capacity. J Chem, 2020 ;2020: 1-14
11. Perumal A, Al Salhi MS, Kanakarajan S, et. al. Phytochemical evaluation and anticancer activity of Rambutan (*Nephelium lappaceum*) fruit endocarp extracts against human hepatocellular carcinoma (HepG-2) cells. Saudi J Biol Sci, 2021; 28(3): 1816-25
12. Nethaji R, Thooyavan G, Mullai Nilla K, et al. Phytochemical profiling, antioxidant and antimicrobial activity of methanol extract in Rambutan fruit (Nephelium lappaceum) epicarp against the human. Int J Comput Intell Res, 2015; 1(9): 201-6
13. Thitilertdecha N, Teerawutgulrag A, Kilburn JD, et al. Identification of Major Phenolic Compounds from Nephelium lappaceum L. and Their Antioxidant Activities. Molecules, 2010; 15: 1453-65
14. Mistriyani, Riyanto, Rohman A. Antioxidant activities of Rambutan (Nephelium lappaceum L) peel in vitro. Food Res, 2018; 2(1): 119-23
15. Widowati W, Maesaroh, Fauziah N, et al. Free Radical Scavenging and α-/β-glucosidase Inhibitory Activities of Rambutan (Nephelium lappaceum L.) Peel Extract. Indones Biomed J, 2015; 7(3): 157–62
16. Harahap SN, Ramli N, Vafaei N, et al. Physicochemical and nutritional composition of rambutananaksekolah (Nephelium lappaceum L.) seed and seed oil. Pak.J Nutr, 2012; 11(11): 1073-77
17. Tsong JL, Goh JPW , Gansau JA, et al. Review of Nephelium lappaceum and Nephelium ramboutan-ake: A High Potential Supplement. Molecules, 2021; 26(7005): 1-16
18. Phoung NN, Le TT, Camp JV, et al. Evaluation of antimicrobial activity of rambutan (Nephelium lappaceum L.) peel extract. Int J Food Microbiol, 2020: 1–9
19. Ahmad SA, Palanisamy UD, Tejo B, et al. Geraniin extracted from the peel of Nephelium lappaceum binds to dengue virus type-2 envelope protein and inhibits early stage of virus replication. Virol J, 2017:1-13
20. Zhuang Y, Sun X, Liu B, et al. Effects of Rambutan Peel (Nephelium lappaceum) Phenolic Extract On RANKL-Induced Differentiation of RAW264.7 Cells into Osteoclasts and Retinoic Acid-Induced Osteoporosis in Rats. Nutrients, 2020:1–14
21. Li Y, Li Z, Hou H, et al. Metal Chelating, Inhibitory DNA Damage, and Anti-Inflammatory Activities of Phenolics from Rambutan (Nephelium lappaceum) Peel and the Quanti-fications of Geraniin and Corilagin. Molecules, 2018:1-12
22. Muhtadi, Haryoto, Sujono TA, et al. Antidiabetic and Antihypercholesterolemia Activities of Rambutan (Nephelium lappaceum L) and Durian (Durio ziberhinus Murr) Fruit Peel Extract. J Appl Pharm Sci, 2016: 190-4
23. Muhtadia, Primariantia AU, Sujonoa TA. Antidiabetic Activity of Durian (Durio zibethinus Murr.) and Rambutan (Nephelium lappaceum L.) Fruit Peels in Alloxan Diabetic Rats. Procedia Food Sci, 2015; 3: 255-61
24. Suhendi A, Muhtadi. Potential activity of Rambutan fruit peel extract as antidiabetic and antihypercholesterol. ICETEA, 2015: 20-3.
25. Emylia K, Snz NA, Dasu\ki M. Preliminary Study on Anti-proliferative Activity of Methanolic Extract of Nephelium lappaceum Peels towards Breast (MDA-MB-231), Cervical (HeLa) and Osteosarcoma (MG-63) Cancer Cell Lines. Health Environ J, 2013: 66–79.

26. Morshed TMI, Dash PR, Ripa FA, et al. Evaluation of pharmacological activities of methanolic extract of Nephelium lappaceum L seeds. Int J Pharmacogn, 2014; 1(10): 632-9
27. Srisawat R, Puengpai S, Nontamart N, et al. Effects of the crude extract of the fruit rind of rambutan (Nephelium lappaceum L) on blood pressure, heart rate and respiratory rate in anaesthetized male rats. Planta Medica, 2010; 76: 638-9

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