 Journal Volume 10,Iss 12, 2021

NUTRITIONAL AND PHYTOCHEMICAL PROFILE OF RAMBUTAN: A CONCISE REVIEW

Sunanda Biswas

Department of Food and Nutrition, Acharya Prafulla Chandra College, Kolkata, India

Abstract: Rambutan (Nephelium lappaceum L.) is a significant fruit in southeast Asia that has garnered increased interest in recent years due to its succulent and sweet nature, as well as its invigorating taste and unique look. The nutritional and functional characteristics of this product make it a widely favoured option for commercialization. This paper explores the bioactive chemicals present in the fruit, peel, and seed. The peel is known to contain antioxidants that have significant importance in several sectors, like cosmetics, pharmaceuticals, and food. The peel extracts have shown several beneficial benefits including, antibacterial, antioxidant, antidiabetic, anti-inflammatory, and antiproliferative properties. Rambutan seed also contains a lot of high-quality fat, protein, carbs, fibre, vitamins, and phenolics, and it can be used in many areas of the food, drug, and cosmetics industries. Nevertheless, more examination is required in order to comprehend the nutritional and phytochemical capabilities of the fruit, as well as the therapeutic processes included in its industrial cultivation as a functional or medicinal food item.

Keywords: Rambutan, peel, seed, antioxidant, nutritional, phytochemical

Introduction:

Rambutan (*Nephelium lappaceum L.*) is known as tropical fruit belonging to the Sapindaceae family. Primarily it is originated from Malaysia, and the origin of its name is the Malay word ¨Rambut¨, which means ¨Hair¨ because of the soft thorns that cover the fruit's surface. This fruit is edible, often ranging in color from red to orange, and has a leathery skin texture with flexible hairy spines. Its form may be oval to spherical (Minh et al., 2019). The leading countries in rambutan fruit cultivation and exportation are Indonesia, Malaysia, and Thailand (Jahurul et al., 2020).

A rambutan tree is a moderately large evergreen tree, measuring 12-20 metres in height, and characterised by its light to dark green compound leaves. Its leaves are 10 -30 cm long and 5-15 cm wide. The fruit is between 3-6 cm long and 3-4 cm wide. The seed is about 2-3 cm long and very dark brown (Suganthi & Josephine, 2016). Rambutan is composed of the following: Dry weight distribution: 26.4% of the total weight, 14.2% peel, 2.59% seed, 12.1% pulp, and 1.56% embryo. The rambutan fruit has juicy, white, transparent, or light pink flesh that is 0.4–0.8 cm thick and has a little sour or sweet taste. The seed with the pulp covering it is ovoid or oblong form and is 2.5–3.4×1–1.5 cm. (Morton, 1987). People eat this fruit fresh, made into a pie, stuffed with pineapple, and canned in syrup (Sirisompong et al., 2011). A diverse range of products can be obtained from the processing of rambutan fruit, including juice, marmalade, syrup, and preserves (Morton, 1987). This fruit has medicinal properties that help alleviate symptoms of fever, diarrhoea, and digestive issues. The dried version of rambutan skin is often used as a traditional medicinal remedy in Malaysia and several other nations. Rambutan leaves has the potential to serve as a therapeutic application for alleviating headaches, whilst the skin may be used as an astringent. The roots of this plant are often ingested to alleviate fever (Palanisamy et al., 2008).

Recent sources state that from 2014 to 2015, Thailand farmed 319,000 tonnes of rambutan fruit. The fruit has a stronger flavour and is high in proteins, carbohydrates, vitamins, minerals, and antioxidants. This fruit is eaten in many ways, including fresh, processed, filled with pineapple (Sirisompong et al., 2011). Some of the most well-liked fresh rambutan products in Malaysia are packaged in syrups, chips, marmalades, jams, and jelly spreads (Jahurul et al., 2020). The most important parts of rambutan are its seeds and peels, which are discarded after being used directly or processed in a factory. The nutritional and therapeutic potential of rambutan fruit and its byproducts are currently the subject of an investigation in the field of health. This current review examines and discourses on the advantages of this fruit with respect to its phytochemical properties and nutritional composition, as well as a recognition of the rambutan byproducts.

Nutritional and Phytochemical Composition:

The weight average of rambutan fruit is determined by the combined weight of its rind, seed, and content (Solis-Fuentes et al., 2010). The nutrient composition of rambutan fruit is indicated in Table 1.

Rambutan pulp:

People eat the juice of a rambutan fresh, and water makes up most of the fruit (Fraire, 2001). Depending on the type of variety, the pulp makes up 36.7% to 48.5% of the whole fruit. It smells a little bit sour to sweet, and it has a pH level of 3.59 and an acidity level of 2.26%. Researchers looked at six types of rambutan—Rongrien, R9, R134, R162, Jitlee, and

ISSN PRINT 2319 1775 Online 2320 7876
Journal Volume 10,Iss 12, 2021

Silengkeng—to find out how to control the amount of minerals they contained (Wall, 2006). The proximate constituents of fresh rambutan was calculated by Fila et al. (2013) using the following measurements: g/100 g; crude protein: 0.66; CHO: 19.66; crude fibre: 0.38; fat: 0.24; and energy: 83.44K/Cals. Around 21.5 mg to 49.5 mg of vitamin C are found in every 100 g of this fruit, which is about the same as other fruits. Thiamine, riboflavin, and niacin are some of the other vitamins that were found. Additionally, certain compounds that are considered antinutritional have been investigated (Mahmood et al., 2018). These include saponins (1.49 mg), phytates (0.14 mg), tannin (0.13 mg), and oxalates (0.12 mg) per 100gm.

Rambutan peels:

The peels from rambutan fruit are considered to be a significant waste product during processing. Based on cultivar and degree of maturity, the rambutan fruit's skin yields 42.1–58.7% weight (Mahmood et al., 2018). The fruit peels contain larger concentrations of antioxidants that are mostly polyphenolic chemicals. It is contained in the fruit's peel and includes phytochemicals like ellagic acid, corilagin, and geraniin (Thitilertdecha et al., 2008). According to Hernández et al. (2017), the rambutan peel contains the following minerals: Cu (0.070), Fe (0.29), Mn (0.14), Mg (0.15), Zn (0.080), K (0.57), Ca (0.51), and Na (0.04). The dried rambutan peel was measured in mg/L. This fruit also included varying amounts of thiamine, ascorbic acid, riboflavin, and niacin. Nevertheless, the dry peel has lower vitamin levels (Thitilertdecha et al., 2010). Peels have been shown to contain a variety of antinutritional compounds, with equivalent amounts of 0.51 g/100 g−1, alkaloids, tannins, phytates, and oxalates. Conversely, a higher concentration of each component is seen in dried peel.

Like as citrus peel, rambutan peel contains pectin for cell wall formation. Stretches and confections employ pectin because of its thickening ability. The fresh rambutan peel has a low methoxy content (10.9%–11.5%) and is black in colour, containing 1.05–1.9 weight percent pectin. Additionally, compared to pomelo pectin, rambutan peel pectin is less soluble. Regretfully, data comparison is not feasible because of insufficient knowledge about cultivars and growing circumstances (Fang & Ng, 2015).

ISSN PRINT 2319 1775 Online 2320 7876

 Journal Volume 10,Iss 12, 2021

Rambutan seeds:

Rambutan seeds are often discarded during fruit processing, but when baked, they are safe to consume and popular in Asian nations. According to Sirimpong et al. (2011), crushed rambutan seeds account for 3.9-10.1% of the total fruit weight, varying on cultivar and maturity degree. Table 1 displays the nutritional composition of rambutan seeds. The seed has 40.3% oleic, 6.1% palmitic, 34.5% arachidonic, 7.1% stearic, 1.5% palmitoleic fatty acids, 2.9% behenic, and 6.3% gondoic, with 50.7% saturated and 48.1% monounsaturated fatty acids. The dried seed has a higher protein, lipid, and carbohydrate content. Rambutan seeds contain essential amino acids like leucine, isoleucine, methionine, lysine, phenylalanine, histidine, and valine, as well as non-essential amino acids like proline, threonine, serine, tyrosine, arginine, alanine, aspartic acid, phenylalanine, cysteine, glycine and glutamic acid.

Rambutan seeds have considerable nutritional value, including carbs, proteins, mucilage, and oil, making them a viable option for future food industry uses. Mahmood et al. (2018a) suggest that the fruit waste may be used for a variety of uses.

Table 1: Nutritional Composition of Rambutan Fruit

Nutrients	Pulp (per 100gm)	Peels (per 100gm)	Seeds (per 100gm)	References
Carbohydrates (g)	33.63–61.5	22.73	15.5–18.99	Hernández-Hernández et al. (2019)
Protein (g)	2.21–2.91	1.95	2.5–3.0	Mahmood et al. (2018)
Lipids (g)	18.20–36.10	0.24	0.45–1.03	Mahmood et al. (2018)
Fiber (g)	0.61–6.5	0.65	0.29–2.7	Manaf et al. (2013)
Thiamine (mg)	0.10	0.05	0.05	Morshed et al. (2014
Riboflavin (mg)	3.42	0.05	21.1–25	Sirisompong et al. (2011)
Niacin (mg)	0.07	0.30	0.025	Muhtadi et al. (2016)

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 10,Iss 12, 2021

Functional properties of Rambutan fruit:

Antioxidant property: The antioxidant impact of rambutan fruit pulp was assessed using the DPPH test, but the results were disappointing. Rambutan seed extracts were tested for antioxidant capacity using ABTS and DPPH tests, yielding 175.08 ± 8.29 and 379.40 ± 11.01 mg g−1 DW, respectively (Chunglok et al., 2014). Thitilertdecha et al. (2008) also assessed the antioxidant activity of seed and peel extracts of rambutan fruit using FRAP, linoleic peroxidation, free radical elimination, and β-carotene bleaching assays. The peel extracts showed stronger antioxidant activity than the seed extracts in all experiments ($P < 0.05$).

Antibacterial property: Antibacterial effects in seed extracts are attributed to phenolics, tannins, and saponins. The antibacterial activity of rambutan seeds was tested using litchi (*Litchi Chenesis*) wet extract solutions. Moderate inhibition of harmful microorganisms was seen in both aqueous extracts. The compound inhibited Gram-positive bacteria (*B. subtilis, S. pyogenes, S. aureus*) and Gram-negative bacteria (*P. aeruginosa, E. coli*). According to Bhat and Al-daihan (2014*),* Litchi showed the highest inhibitory potential compared to S. pyogenes. Thitilertdecha studied the relationship between rambutan seeds and their peel extracts, analysing eight pathogenic bacteria strains (*E. coli, K. pneumoniae, S. aureus, S. typhi, V. cholera, S. epidermidis, P. aeruginosa,* and *E. faecalis*) (Thitilertdecha et al., 2008). Rambutan peel extract and seed showed greater antibacterial activity against pathogenic bacterial strains for *E. faecalis, S. epidermidis, and S. aureus*, but not against the remaining three bacteria (Chunglok et al., 2014).

Antiallergic property: Allergens cause allergic responses in living cells. Histamine and hexosaminidase are released during a basophil allergic reaction. A research assessed allergic responses with ethanolic and aqueous rambutan pulp extracts. Researchers examined the impact of hexosaminidase on basophilic leukaemia cells (RBL-2H3) (Cheong et al., 1998). The ethanolic and warm water extracts exhibited inhibition of hexosaminidase activity of 81.96% and 85.49%, respectively. The warm water extract had a higher IC50 (61.5 g mL−1) than ethanol (31.0 μg mL−1) (Cruz et al., 2017). The concentrations at which hexosaminidase inhibition of seed extract of rambutan was tested were as follows: 67.40%, 66.95%, 60.75%, and 34.75% for 100 g mL−1 of tepid water, ethanol, and hexosaminidase at atmospheric temperature, respectively (Mahmood et al., 2018).

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 10,Iss 12, 2021

Anti-inflammatory property: The anti-inflammatory properties of rambutans were investigated using ethanolic extract solutions derived from all parts of the fruit. It was found that rambutan inhibited TNF-secretion, but had no impact on IL-8 secretion (Chingsuwanrote et al., 2016). Rambutan methanol seed extract showed analgesic and anti-inflammatory effects in a research. Morshed et al. (2014) found that their seed extract shows 58.86% anti-inflammatory and 52.10% analgesic properties. In addition, the antihyperalgesic effect of rambutan methanolic extract in seeds was examined using the Eddy hot plate technique. The study found that crude methanol seed extract had greater antinociceptive effectiveness than cooked and roasted extracts (Rajasekaran et al., 2013). The anti-inflammatory properties of ethanolic rambutan pulp extracts were shown in Rongrien and Sichompu fruit. Due to the antioxidant properties of reactive molecules in both components, ethanolic extracts of both types reduced TNF release but did not impact IL-8.

Antiproliferative property: Three fruits, tamarind, litchi, and rambutan, were investigated for cell proliferation inhibition. The seed and fruit peels methanolic extracts showed antiproliferative effects (Chunglok et al., 2014). CLS-354 was shown to have an antiproliferative impact on human oral cancer cells. Rambutan seed extract was not hazardous to human cancer cells (CLS-354 or PBMC 3), but MTT reduction test and annexin V-FITC/PI staining were used to assess chemotherapeutic and apoptotic effects. Rambutan peel was shown to have antiproliferative effects on osteosarcoma cancer cells (MG-63), breast cancer cells (MDA-MB-231) and cervical cancer cells (He.La). In the research, rambutan like yellow and red varieties was employed. The cytotoxicity of rambutan peel extract was tested in vitro using methyl blue and cisplatin on a typical MDCK cell line. The methanolic extract of yellow rambutan peel inhibited MDAMB231 and MG63. Both rambutans lack antiproliferative capabilities, unlike He.La cells (Khaizil Emylia et al., 2013).

Anti-diabetic property: The antidiabetic efficacy of rambutan seed extract was strong against glucosidase inhibition. A 50 g dosage of rambutan seed extract and hexane fractions inhibited G6PDH and glucosidase, according to Soeng (2015). Rambutan seed powder was tested for its antidiabetic effects at a dose of 25 mg/mL^{-1}. Results showed that it increased glucose elevation (Cruz et al., 2017). Another research demonstrated that rambutan seed

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 10,Iss 12, 2021

infusions reduced blood sugar levels and weight in mice treated with alloxan tetrahydrate. A seed infusion of 2.85 g kg−1 bw was administered to mice, demonstrating glucose inhibition (Rahayu et al., 2013). Research indicates that peel extract may have anti-diabetic properties. The research discovered that peel extract of rambutan increase body weight and decrease blood sugar levels. In diabetic mice, it detects lipids, total cholesterol, and serum protein levels as per dose. Using rambutan peel extract, mice hepatic glycogen content was restored (Ma et al., 2017).

Conclusion:

Research indicates that rambutan fruit, pulp, and seeds contain bioactive components and are a vital commercial fruit. Numerous studies indicate bioactive components in pulp, seeds, and peels have nutritional and pharmaceutical benefits, including antibacterial, antioxidant, antidiabetic, anti-inflammatory, and antiproliferative characteristics. The review highlights the potential of both edible and inedible rambutan fruit in functional food items. Using correct procedures and processing technology, rambutan fruit and its byproducts may be used in low-cost food items as useful components. Further study on underutilization of rambutan fruit is needed to explore the potential.

References:

- Bhat, R. S., & Al-daihan, S. (2014). Antimicrobial activity of *Litchi chinensis* and *Nephelium lappaceum* aqueous seed extracts against some pathogenic bacterial strains. Journal of King Saud University - Science, 26(1), 79–82.
- Chunglok, W., Utaipan, T., Somchit, N., Lertcanawanichakul, M., & Sudjaroen, Y. (2014). Antioxidant and antiproliferative activities of non-edible parts of selected tropical fruits. Sains Malaysiana, 43(5), 689–696.
- Cruz, L., Avupatiz, V. R., & Ghori, S. A. (2017). Mechanistic studies on the effect of Nephelium lappaceum seed powder on in vitro glucose uptake by Saccharomyces cerevisiae. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 8(6), 321–327.
- Fang, E. F., & Ng, T. B. (2015). A trypsin inhibitor from rambutan seeds with antitumor, anti-HIV-1 reverse transcriptase, and nitric oxideinducing properties. Applied Biochemistry and Biotechnology, 175(8), 3828–3839.
- Fila, W., Itam, E., & Johnson, J. (2013). Comparative proximate compositions of watermelon Citrulluslanatus, Squash Cucurbita Pepo'l and rambutan Nephelium Lappaceum. International Journal of Science and Technology, 2(1), 81–88.

ISSN PRINT 2319 1775 Online 2320 7876
Journal Volume 10,Iss 12, 2021

- Fraire, V. G. (2001). El rambután: Alternativa para la producción frutícola del trópico húmedo de México. Instituto Nacional de Investigaciones Forestales Agrícolasy Pecuarias (INIFAP), Campo Experimental Rosario Izapa, Chiapas. Folleto TécnicoNó. 1. Tuxtla Chico, Chiapas. 41.
- Hernández, C., Ascacio-Valdés, J., De la Garza, H., Wong-Paz, J., Aguilar, C. N., Martínez-Ávila, G. C., Aguilera-Carbó, A. (2017). Polyphenolic content, in vitro antioxidant activity and chemical composition of extract from Nephelium lappaceum L. (Mexican rambutan) husk. Asian Pacific Journal of Tropical Medicine, 10 (12), 1201–1205.
- Hernández-Hernández, C., Aguilar, C. N., Rodríguez-Herrera, R., FloresGallegos, A. C., Morlett-Chávez, J., Govea-Salas, M., & AscacioValdés, J. A. (2019). Rambutan (Nephelium lappaceum L.): Nutritional and functional properties. Trends in Food Science & Technology, 85, 201–210.
- Jahurul, M. H. A., Azzatul, F. S., Sharifudin, M. S., Norliza, M. J., Hasmadi, M., Lee, J. S., Patricia, M., Jinap, S., George, M. R., Khan, M. F., & Zaidul, I. S. M. (2020). Functional and nutritional properties of rambutan (Nephelium lappaceum L.) seed and its industrial application: A review. Trends in Food Science & Technology, 99, 367–374.
- Jahurul, M. H. A., Azzatul, F. S., Sharifudin, M. S., Norliza, M. J., Hasmadi, M., Lee, J. S., Patricia, M., Jinap, S., George, M. R., Khan, M. F., & Zaidul, I. S. M. (2020). Functional and nutritional properties of rambutan (Nephelium lappaceum L.) seed and its industrial application: A review. Trends in Food Science & Technology, 99, 367–374.
- Khaizil Emylia, Z., Aina, S. N., & Dasuki, S. M. (2013). 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 and Environment Journal, 4, 66–79.
- Ma, Q., Guo, Y., Sun, L., & Zhuang, Y. (2017). Anti-diabetic effects of phenolic extract from rambutan peels (Nephelium lappaceum) in high-fat diet and streptozotocin-induced diabetic mice. Nutrients, 9(8), 801.
- Manaf, Y. N. A., Marikkar, J. M. N., Long, K., & Ghazali, H. M. (2013). Physico-chemical characterisation of the fat from red-skin rambutan (Nephellium lappaceum L.) seed. Journal of Oleo Science, 62(6), 335–343.
- Mahmood, K., Kamilah, H., Alias, A. K., & Ariffin, F. (2018). Nutritional and therapeutic potentials of rambutan fruit (Nephelium lappaceum L.) and the by-products: A review. Journal of Food Measurement and Characterization, 12(3), 1556–1571.
- Mahmood, K., Fazilah, A., Yang, T.A., Sulaiman, S. & Kamilah, H. (2018 a). Valorization of rambutan (Nephelium lappaceum) by-products: Food and non-food perspectives. International Food Research Journal, 25(June), 890–902.
- Minh, N. P., Vo, T. T., Trung, Q. V., Van Bay, N., & Loc, H. T. (2019). Application of CMC, xanthan gum as biodegradable coating on storage of rambutan (Nephelium lappaceum) fruit. Journal of Pharmaceutical Sciences and Research, 11(3), 1063–1067.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper© 2012 IJFANS. All Rights Reserved, Journal Volume 10,Iss 12, 2021

- Morshed, T. M. I., Dash, P. R., Ripa, F. A., Foyzun, T., & Ali, M. S. (2014). Evaluation of pharmacological activities of methanolic extract of Nephelium lappaceum L. seeds. International Journal of Pharmacognosy, 1(10), 632–639.
- Morton, J.(1987). Fruits of Warm Climates .CAB Direct, Miami. 2765–2766.
- Muhtadi, M., Haryoto, H., Sujono, T. A., & Suhendi, A. (2016). Antidiabetic and antihypercholesterolemia activities of rambutan (Nephelium lappaceum L.) and durian (Durio zibethinus Murr.) fruit peel extracts. Journal of Applied Pharmaceutical Science, 6(4), 190–194.
- Palanisamy, U., Cheng, H. M., Masilamani, T., Subramaniam, T., Ling, L. T., & Radhakrishnan, A. K. (2008). Rind of the rambutan, Nephelium lappaceum, a potential source of natural antioxidants. Food Chemistry, 109(1), 54–63.
- Rahayu, L., Zakir, L., & Keban, S. A. (2013). The effect of rambutan seed (Nephelium lappaceum L.) infusion on blood glucose and pancreas histology of mice induced with alloxan. Jurnal Ilmu Kefarmasian Indonesia, 11(1), 28–35.
- Rajasekaran, A., Ganesan, S., Kamini, N., Lavanya, C., Lee Yoon, L., & Shian Oh, H. (2013). Anti-nociceptive, CNS, antibacterial and antifungal activities of methanol seed extracts of Nephelium lappaceum L. Oriental Pharmacy and Experimental Medicine, 13(2), 149–157.
- Sirisompong, W., Jirapakkul, W., & Klinkesorn, U. (2011). Response surface optimization and characteristics of rambutan (Nephelium lappaceum L.) kernel fat by hexane extraction. LWT - Food Science and Technology, 44(9), 1946–1951.
- Sirisompong, W., Jirapakkul, W., & Klinkesorn, U. (2011). Response surface optimization and characteristics of rambutan (Nephelium lappaceum L.) kernel fat by hexane extraction. LWT - Food Science and Technology, 44(9), 1946–1951.
- Soeng, S. (2015). Antioxidant and hypoglycemic activities of extract and fractions of Rambutan seeds (Nephelium lappaceum L.). Biomedical Engineering, 1(1), 6.
- Solís-Fuentes, J. A., Camey-Ortíz, G., Hernández-Medel, M. del R., Pérez-Mendoza, F., & Durán-de-Bazúa, C. (2010). Composition, phase behavior and thermal stability of natural edible fat from rambutan (Nephelium lappaceum L.) seed. Bioresource Technology, 101(2), 799–803.
- Suganthi, A., & Marry Josephine, R. (2016). (Nephelium Lappaceum L.): An overview. International Journal of Pharmaceutical Science and Research, 1(5), 36–39.
- Thitilertdecha, N., Teerawutgulrag, A., & Rakariyatham, N. (2008). Antioxidant and antibacterial activities of Nephelium lappaceum L. extracts. LWT-Food Science and Technology, 41(10), 2029–2035.
- Thitilertdecha, N., Teerawutgulrag, A., Kilburn, J. D., & Rakariyatham, N. (2010). Identification of major phenolic compounds from Nephelium lappaceum L. and their antioxidant activities. Molecules, 15(3), 1453–1465.
- Wall, M. M. (2006). Ascorbic acid and mineral composition of longan (Dimocarpus longan), lychee (Litchi chinensis) and rambutan (Nephelium lappaceum) cultivars grown in Hawaii. Journal of Food Composition and Analysis, 19(6–7), 655–663.