

Original Research Article

Profiling nutrient composition and antioxidant potential of rambutan (*Nephelium lappaceum* L) peel

ABSTRACT

The present study was conducted to assess the nutri-chemical composition and antioxidant potential of rambutan fruit (*Nephelium lappaceum* L) peel. Red rambutan fruit peel was used in fresh as well as dried form for the study. The nutri-chemical profiling revealed, fresh peel had 24g/100g of carbohydrate, 2.5g/100g of protein, 0.17g/100g of fat and 0.89g/100g starch. However, dried peel had 55.45g/100g carbohydrate, 5.25g/100 protein, 10.2g/100g fat and 1.00g/100g starch. Crude fiber content of the fresh and dried peel was 0.77g/100g and 0.068g/100g respectively. Moreover, the fresh peel had higher moisture (73%) content than dried peel (4.2%). Vitamin C being heat liable, was found higher in fresh peel (9.31mg/100g). Sodium and potassium levels were found higher in dried peel powder as 1.55mg/100g and 9.4mg/100g respectively. Phytochemical composition of rambutan peel revealed that total polyphenol was higher in dried peel (580mg/100g) when compared to fresh (310mg/100g), meanwhile saponin, tannin and terpenoid were found higher in fresh peel as 47mg/100g, 390mg/100g and 5.101mg/100g respectively. Flavonoid content was dominant in dried peel (20.51mg/100g) than that of fresh peel (9.6mg/100g). The radical-scavenging activity was expressed as IC₅₀, which reported dried peel (43.79µg/100mL) had strong antioxidant potential than fresh peel (184.39µg/100mL). However, it is concluded that rambutan peel is a potent source of nutrients, bioactive compounds and antioxidants which in turn has immense therapeutic benefits. Furthermore, valorisation of agri-food wastes and by-products can enhance food security and promote sustainable development.

Keywords: Rambutan, peel, Nutrient, Phytochemical, antioxidant

INTRODUCTION

Plants have consistently been the primary source of medicine for preventive and curative purposes since ancient times. Tropical fruits are of great significance in human diet due to its ample nutritional and therapeutic benefits. Rambutan is one such tropical fruit which belongs to the Sapindaceae family and is indigenous to Southeast Asian tropical regions. *Nephelium lappaceum* L. commonly referred to as 'Rambutan', is an evergreen tree reaching heights of about 10-12 m, characterized by greyish-brown branches. The fruit's name, 'rambutan', originates from the Malay word 'rambut', meaning "hair", due to the numerous hairy protuberances covering its surface. The fruit is an ovoid berry, ranging in colour from yellow to orange-red, or from red to maroon.

The peel of the rambutan constitutes 45% of the entire fruit. According to Nur (2021) rambutan fruit peel, was mostly used as trash around the community, even though it has

extraordinary properties. Its skin that contains xanthones as a strong antioxidant, is needed by the body as a counterweight to prooxidants. The health benefits of rambutan peel are closely tied to its nutri-chemical composition, particularly its high levels of nutrients and bioactive components. Research indicates that rambutan fruit, especially peel, contain nutrients and bioactive components, that possess numerous pharmaceutical benefits, including antibacterial, antioxidant, antidiabetic, anti-inflammatory, and antiproliferative characteristics. However, exploring the therapeutic potential of rambutan peel, aids in solution for management of lifestyle diseases. To date, there has been a lack of research on nutrient and phytochemical quantification, particularly in the peel of rambutan. Certainly! Further research is necessary to fully understand the phyto-therapeutic potential of the fruit.

Considering its nutrition and health benefits, there is a need to promote this fruit and its underutilised fruit parts for health and preventive medicine. However, systemic documentation of the nutrients and chemical constituents is lacking, thus an evaluation of nutrient and phytochemical profile of the parts of rambutan fruit would enlighten the health-conscious population, regarding the nutritive and antioxidant potential of rambutan peel. This comprehensive examination will provide valuable insights into maximizing the fruit peels benefits and applications. Furthermore, the valorization of agri-food wastes and by-products can enhance regional food security and promote sustainable food production.

MATERIALS AND METHODS

Fresh ripened red rambutan (*Nephelium lappaceum* L.) fruits were collected from organic farms of Kottayam district of Kerala, India for conducting the detail study. The samples were bought when available (July-September) in their fresh state. Proximate, bio-active compounds and antioxidant potential of the fresh and dried rambutan peel was studied using standard procedures.

Rambutan peel powder was developed using the peel of red rambutan fruit, initially peel was washed in distilled water, cleaned and wiped to remove specks of dirt, it was then cut into small pieces and then dried in the thermo-statically controlled electric oven, at 40°C for 48 hrs. The dried fruit peel was then pulverised to produce fruit powder. The peel powder was then sealed and stored in laminated aluminium pouches to maintain a dry environment and prevent the oxidation of bioactive compounds.

Assessment of nutrients

Carbohydrate content in the fresh as well as dried rambutan peel was estimated using Anthrone method developed by Hedge and Hofreiter, (1962). Protein content was determined using a semi-automatic KjelTRON, following slight modifications in AOAC (2005). The fat content was determined using modified Batch Solvent Extraction method (Min and Steenson, 1998) using hexane as solvent. Slightly modified method of Hansen and Moller, (1975) was used for estimation of starch. The procedure outlined by Rahul *et al.* (2010) was adopted for the estimation of crude fiber. The determination of vitamin C content was done with 2,6-dichlorophenol indophenol (DCPIP) titration method, as outlined by Sadasivam and Manikkam. (2008). Sodium, potassium and moisture content of fresh and dried rambutan peel was

estimated using AOAC (1990).

Assessment of Phytochemicals

The total flavonoid content in the fresh as well as dried rambutan peel was determined through the aluminum chloride colorimetric assay, following the method described by Lee and Ismail (2012). Procedure outlined by Chen *et al.* (2010) was adopted for estimation of saponin. Content of tannins in sample was determined by Folin-Ciocalteu method outlined by Sadasivam and Manickam (2008). The total polyphenol content was analysed using the Folin-Ciocalteu method, following the procedure developed by Ondo *et al.* (2013). Procedure outlined by Chang *et al.* (2012) was adopted for estimation of Terpenoid content.

Assessment of antioxidants

The total antioxidant capacity of the fresh and dried rambutan peel extract was assessed using the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) method, following the procedure outlined by Kevin and Saleh, (2013).

RESULTS AND DISCUSSION

Rambutan fruit undergoes a sequence of transformations as it progresses through various stages of maturation. These changes encompass shift in texture, colour, flavour and nutrient composition.

Fruit peel, also referred to as rind or skin, serves multiple functions in fruits. It acts as a protective barrier, shielding the inner flesh from physical damage, microbial attack, and dehydration. Additionally, fruit peel often contains essential nutrients, flavor compounds, and dietary fiber. Table 1. represents the nutrient composition of fresh vs dried rambutan peel.

Table 1. Nutrient composition of fresh and dried rambutan peel

Treatment	Carbohydrate (g/100g)	Protein (g/100g)	Fat (g/100g)	Starch (g/100g)	Crude fiber (g/100g)	Vitamin C (mg/100g)	Sodium (mg/100g)	Potassium (mg/100g)	Moisture (g/100g)
Fresh peel	24.0±0.89	2.5±0.08	0.17±0.00	0.89±0.041	0.77±0.06	9.31±0.41	0.35±0.01	4.7±0.04	73±1.14
Dried Peel	55.45±3.94	5.25±0.35	10.2±0.00	1.00±0.05	0.068±0.001	5.00±0.62	1.55±0.71	9.40±0.18	4.20±0.17

Results are expressed as mean ± SD of six replicants

The fresh rambutan peel contained, 24.0g/100g of carbohydrates, 2.50g/100g of protein, 0.17g/100g of fat, and 0.89g/100g of starch. According to Afza *et al.* (2023) dried peel of rambutan contained three to four times higher quantity of protein and fat when compared to the fresh peel, which is on par with the results of the present study. The nutrient content of the dried rambutan peel revealed that, dried peel had 55.45g/100g carbohydrate,

5.25g/100 protein, 10.2g/100g fat and 1.00g/100g starch. Crude fiber content of the fresh and dried peel is 0.77g/100g and 0.068g/100g respectively.

According to Thitilertdechaet *et al.*, (2010) the vitamin content of dried rambutan peel was lower than that of fresh peel, this might be related to vitamin heat labile when dehydrated at 55°C for 24h. However, in the present study, Vitamin C content in fresh peel (9.31mg/100g) was higher than that of the dried rambutan peel (5.00mg/100g). Sodium and potassium content of the fresh peel was 0.35mg/100g and 4.70mg/100g respectively, whereas, the dried peel had higher sodium (1.55mg/100g) and potassium (9.40mg/100g) level. Fang and Ng (2015) reported the moisture content of fresh rambutan peel was 71.05g/100g, however, in the present study fresh peel (73.00 g/100g) had higher moisture content than dried rambutan peel (4.20 g/100g).

Phenolic chemicals are secondary metabolites found in plants that have a variety of biological roles. These substances belong to one of the broadest categories of bioactive substances that have a backbone made up of one or more hydroxyl groups and aromatic rings. The results of the phytochemical composition of fresh and dried rambutan peel are expressed in **Table 2**.

According to Dembitsky *et al.* (2011) the ethanolic extract of rambutan peel extract had a total phenolic content of 762± 10 mg GAE/g extract, which is comparable to that of a commercial preparation of grape seed extract. Total polyphenol in fresh rambutan peel was 310mg/100mg and 580mg/100mg in dried peel. Saponin content of the fresh peel was 47.1mg/100g, whereas dried peel had 43.9mg/100g. Tannin content was lower in dried peel (299.6mg/100g) when compared to the fresh peel (390mg/100g). Flavonoid content in fresh peel was reported to be 9.60mg/100g, when dried flavonoid content increased to 20.51mg/100g. Fresh peel (5.10 mg/100g) had higher terpenoid content than the dried peel (4.09 mg/100g).

Table 2. Phytochemical composition of fresh rambutan peel

Treatment	Total Polyphenol (mg/100g)	Saponin (mg/100g)	Tannin (mg/100g)	Flavonoid (mg/100g)	Terpenoid (mg/100g)
Fresh peel	310.0±0.70	47.11±0.09	390.0±2.28	9.60±0.08	5.101±0.18
Dried peel	580.0±5.96	43.9±0.60	299.63±0.47	20.51±0.58	4.09±0.20

Results are expressed as mean ± SD of six replicants

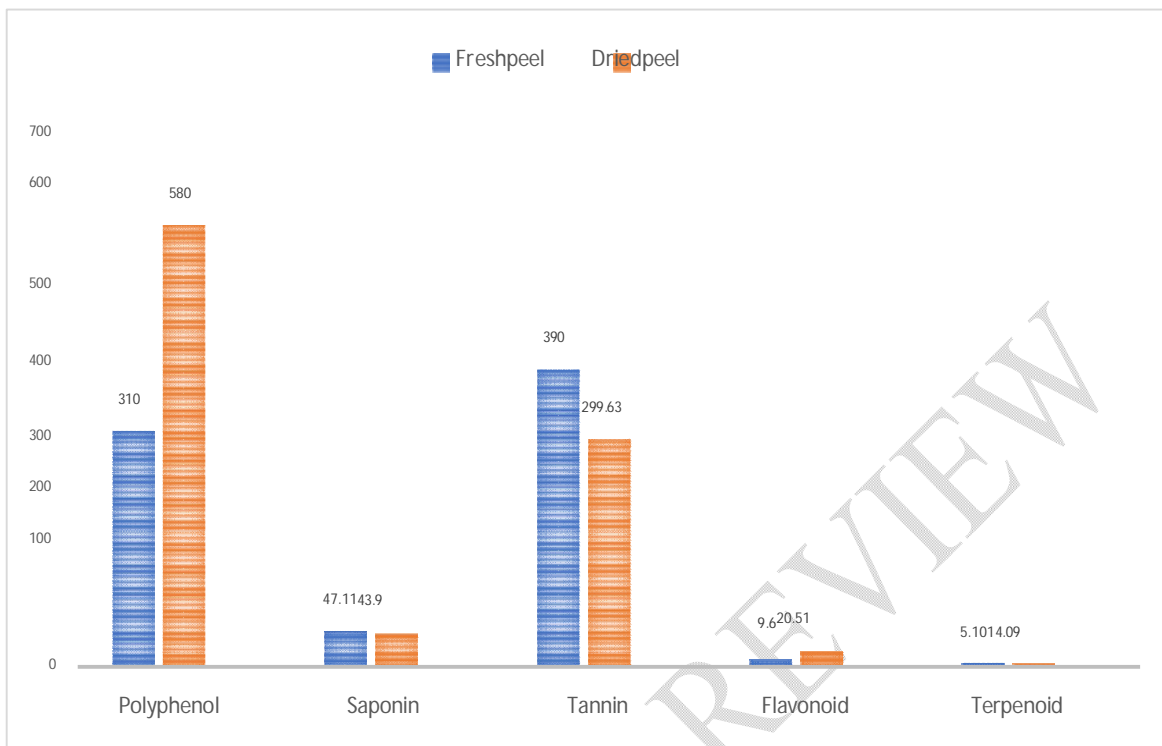


Fig. 1. Phytochemical composition of Fresh and dried rambutan peel

Radical-scavenging activity of rambutan peel was expressed as IC_{50} , IC_{50} is the half-maximal inhibitory concentration. In this study DPPH assay was used to assess the antioxidant content of ethanolic extract of fresh and dried rambutan peel. The IC_{50} value of fresh and dried rambutan peel extracts is expressed in Table 3. The ethanolic extract of dried peel showed the higher antioxidant activity, with an IC_{50} value of $43.79 \mu\text{g/ml}$, when compared to fresh rambutan peel ($184.39 \mu\text{g/ml}$). The increase in the antioxidant activity of dried peel is due to the higher concentration of polyphenols and flavonoids reported in the dried peel (580 mg/100g and 20.51 mg/100g respectively) than that of fresh peel (310 mg/100g and 9.60 mg/100g respectively).

Table 3. Antioxidant content of rambutan peel

Parameter	Fresh peel	Dried peel
Antioxidant IC_{50} ($\mu\text{g/100ml}$)	184.39 ± 0.77	43.790 ± 0.75

Results are expressed as mean \pm SD of six replicants

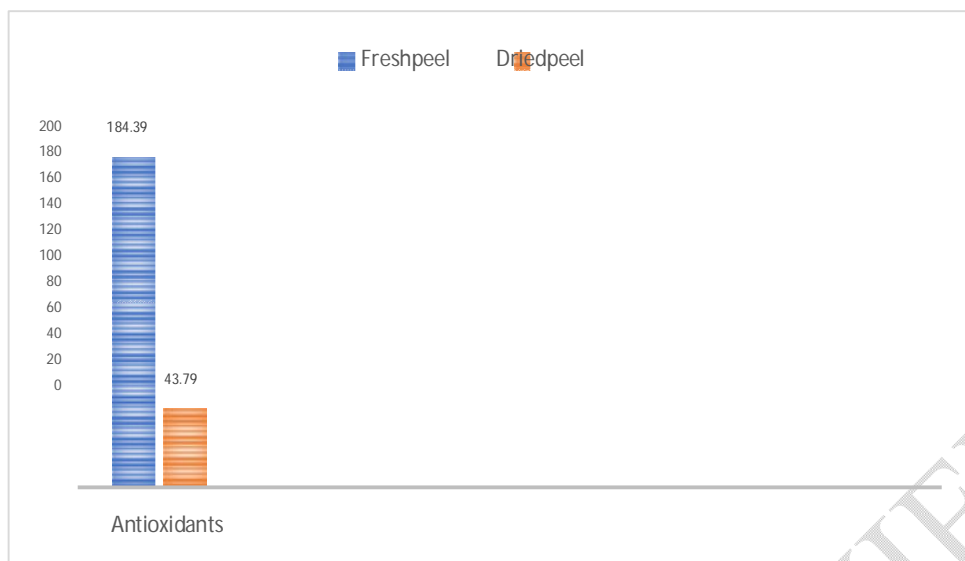


Fig.2 Antioxidant activity (IC50) of fresh and dried rambutan peel

CONCLUSION

Rambutan (*Nephelium lappaceum* L.) is a very popular plant in Malaysia, Indonesia and other South Asian countries for its edible fruits, though the fruit peel constitutes 45% of the entire fruit. It is considered as a trash and accumulated as agriculture food waste. The health benefits of rambutan peel are closely related to its nutri-chemical composition, particularly its high levels of nutrients and bioactive components. In this study, fresh as well as dried rambutan peel was studied for its nutritional, photochemical and antioxidant potential. However, it is concluded that rambutan peel is a potent source of nutrients, bioactive compounds and antioxidants which in turn has immense therapeutic and nutraceutical benefits. Furthermore, valorisation of agri-food wastes and by-products can enhance food security and promote sustainable development. However, systemic documentation of the nutrients and chemical constituents is lacking, thus an evaluation of nutrient and phytochemical profile of the part of rambutan fruit would enlighten the health-conscious population.

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Conflict of interest. None.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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