Original Research Article

Nutrientcompositionandantioxidantpotentialof rambutan (*Nephelium lappaceum*L) peel

ABSTRACT

The present study was conducted to assess the nutri-chemical composition and antioxidantpotentialoframbutanfruit(*Nepheliumlappaceum*L)peel.Redrambutanfruitpeel 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/100gstarch. Crude fiber content of the fresh and dried peel was 0.77g/100gand0.068g/100grespectively.Moreover,thefreshpeelhadhighermoisture(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 was found higher in dried peel powder as 1.55mg/100g and 9.4mg/100g respectively. Phytochemical composition of rambutan peel revealedthattotalpolyphenolwashigherindriedpeel(580mg/100g)whencomparedtofresh (310mg/100g), meanwhile saponin, tannin and terpenoid was found higher in fresh peel as 47mg/100g,390mg/100gand5.101mg/100grespectively.Flavonoidcontentwasdominantin dried peel (20.51mg/100g) than that of fresh peel (9.6mg/100g). The radical-scavenging activity was expressed as IC_{50}, 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 duetoitsamplenutritionalandtherapeuticbenefits.Rambutanisonesuchtropicalfruitwhich 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',originatesfromtheMalayword'rambut',meaning"hair",duetothenumeroushairy 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) rambutanfruitpeel,wasmostlyusedastrasharoundthecommunity,eventhoughithas

extraordinaryproperties.Itshairrindthatcontainsxanthonesasastrongantioxidant,isneeded bythebodyasacounterweighttoprooxidants.Thehealthbenefitsoframbutanpeelareclosely 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 bioactivecomponents,thatpossessnumerouspharmaceuticalbenefits,includingantibacterial, 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,particularlyinthepeeloframbutan.Certainly!Furtherresearchisnecessaryto fully understand the phyto-therapeutic potential of the fruit.

Consideringitsnutritionandhealthbenefits,thereisaneedtopromotethisfruitandits underutilisedfruitpartsforhealthandpreventivemedicine.However,systemicdocumentation of the nutrients and chemical constituents is lacking, thus an evaluation of nutrient and phyto chemicalprofileofthepartsoframbutanfruitwouldenlightenthehealth-consciouspopulation, 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.

MATERIALSANDMETHODS

Fresh ripened red rambutan (*Nephelium lappaceum*L.) fruits were collected from organicfarmsofThiruvananthapuram and KottayamdistrictofKerala,Indiaforconductingthedetailstudy.Thesamples 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 peelwaswashedindistilledwater,cleanedandwipedtoremovespecksofdirt,itwasthencut intosmallpiecesandthendriedinthermo-staticallycontrolledelectricoven,at40°Cfor48h. The dried fruit peel was then pulverised to produce fruit powder. The peel powder was then sealedandstoredinlaminatedaluminiumpouchestomaintainadryenvironmentandprevent the oxidation of bioactive compounds.

Assessmentofnutrients

Carbohydrate content in the fresh as well as dried rambutan peel was estimated using AnthronemethoddevelopedbyHedgeandHofreiter,(1962).Proteincontentwasdetermined usingasemi-automaticKjelTRON,followingslightmodificationsinAOAC(2005).Thefat 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 adoptedfortheestimationofcrudefiber.ThedeterminationofvitaminCcontentwasdonewith 2,6- dichlorophenol indophenol (DCPIP) titration method, as outlined by Sadasivam and

Manikkam.(2008).Sodium,potassiumandmoisturecontentoffreshanddriedrambutanpeel was estimated using AOAC (1990).

AssessmentofPhytochemicals

Thetotalflavonoidcontentinthefresh as wellas driedrambutanpeelwas determined throughthealuminumchloridecolorimetricassay,followingthemethoddescribedbyLeeand Ismail(2012).ProcedureoutlinedbyChen*etal*,(2010)wasadoptedforestimationofsaponin. Content of tannins in sample was determined by Folin-Ciocalteu method outlined by SadasivamandManickam(2008).ThetotalpolyphenolcontentwasanalysedusingtheFolin-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.

Assessmentofantioxidants

Thetotalantioxidantcapacityofthefreshanddriedrambutanpeelextractwasassessed usingthe2,2-Diphenyl-1-picrylhydrazyl(DPPH)method,followingtheprocedureoutlinedby Kevin and Saleh, (2013).

RESULTSANDDISCUSSION

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,fruitpeeloftencontainsessentialnutrients,flavorcompounds,and dietaryfiber.Table1.representsthenutrientcompositionoffresh vs driedrambutanpeel.

Table1.Nutrientcompositionoffresh and dried rambutanpeel

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

Resultsareexpressedasmean±SDofsixreplicants

The fresh rambutan peelcontained, 24.0g/100g of carbohydrates, 2.50g/100g of protein, 0.17g/100g of fat, and 0.89g/100gofstarch.AccordingtoAfzaal*etal.*(2023)driedpeelsoframbutancontainedthree tofourtimeshigherquantityofproteinand fatwhencomparedto thefresh peel, which is on par

with the results of the present study.Thenutrient contentofthedriedrambutanpeelrevealedthat,driedpeelhad55.45g/100g carbohydrate, 5.25g/100 protein, 10.2g/100g fat and 1.00g/100gstarch, which is in line with the results of Afzaal*etal.*(2023).

Wanlapa*et al.*, (2015) reported that protein content in dried peel of Thailand rambutans as 6.36g/100g, which is in similar trend to the current results. Wanlapa*et al*., 2015. ascribed some rambutan varieties from Thailand was found to have 0.89g/100g fat in the dried rambutan peel. Crude fiber content of the fresh and dried peel is 0.77g/100g and 0.068g/100g respectively.

According to Thitilertdecha*et al*., (2010) the vitamin content of dried rambutan peel waslowerthanthatoffreshpeel,thismightberelatedtovitaminheatlabilewhendehydrated at55°Cfor24h.However,inthepresentstudy,VitaminCcontentinfreshpeel(9.31mg/100g) washigherthanthatofthedriedrambutanpeel(5.00mg/100g).Sodiumandpotassiumcontent ofthefreshpeelwas0.35mg/100gand4.70mg/100grespectively,whereas,thedriedpeelhad higher sodium (1.55mg/100g) and potassium (9.40mg/100g) level. Fang and Ng (2015) reportedthemoisturecontentoffreshrambutanpeelwas71.05g/100g,however,inthepresent study fresh peel (73.00 g/100g) had higher moisture content that 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 substancesthat haveabackbonemadeup ofoneormorehydroxylgroupsandaromaticrings. The results of the phytochemical composition of fresh and dried rambutan peel are expressed in Table 2.

AccordingtoDembitsky*etal*.(2011)theethanolicextractoframbutanpeelextracthad a total phenolic content of 762±10 mg GAE/g extract, which is comparable to that of a commercial preparation of grape seed extract. According to Hern´ande*zet al*., (2017) aqueous extract of rambutan peel has 457mg/g polyphenols which is similar to the total polyphenol obtained in present study. 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).

Supradip*et al.*, 2010.reported that saponins and tannins are well known for its wide range ofpharmacological benefits like anti-inflammatory, antidiabetic, antimicrobial, anticonvulsant, antispasmodic, anticancer, and other cytotoxic activities. Therefore, presence of these bioactive compounds in rambutan peel emphasis its role in the management of life style diseases.

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).

Table2.Phytochemicalcompositionoffreshrambutanpeel

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

Resultsareexpressedasmean±SDofsixreplicants

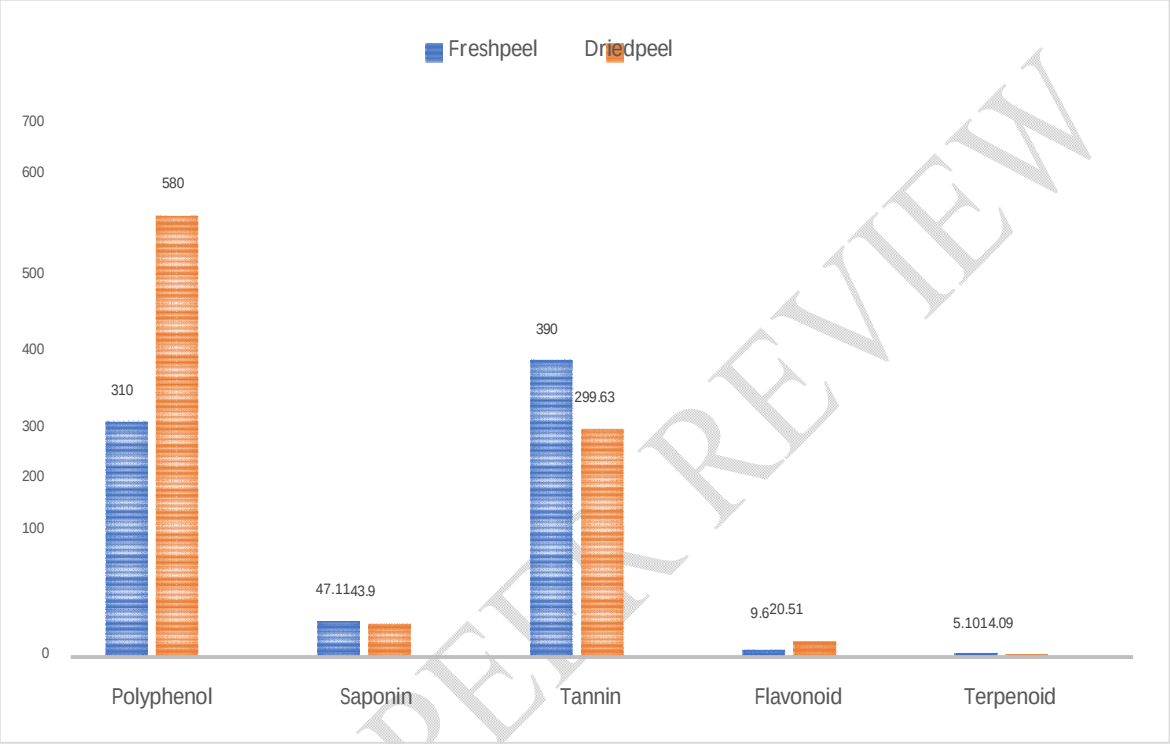

Fig.1.Phytochemicalcomposition of Fresh and dried rambutan peel

Radical-scavenging activity of rambutan peel was expressed as IC_{50}, $IC_{50}$is the half-maximalinhibitoryconcentration.InthisstudyDPPHassaywasusedtoassesstheantioxidant contentofethanolicextractoffreshanddriedrambutanpeel.TheIC_{50}valueoffreshanddried rambutan peel extracts is expressed inTable3.Theethanolicextract of dried peel showed the higher antioxidant activity, with an IC_{50}value of 43.79µg/ml, when compared to fresh rambutan peel (184.39µg/ml). The increase in the antioxidant activity of dried peel is due to the higher concentrationofpolyphenolsandflavonoidsreportedinthedriedpeel(580mg/100gand20.51 mg/100g respectively) than that of fresh peel (310mg/100g and 9.60mg/100g respectively).

Table3.Antioxidantcontentoframbutanpeel

Parameter	Freshpeel	Driedpeel

Antioxidant IC_{50} (µg/100ml)	184.39±0.77	43.790±0.75

Resultsareexpressedasmean±SDofsixreplicants

CONCLUSION

Rambutan(*Nepheliumlappaceum*L)isaverypopularplantinMalaysia,Indonesiaand other SouthAsian countries for its edible fruits, though the fruit peel constitute 45% of entire fruit.Itisconsideredasatrashandaccumulatedasagriculturefoodwaste.Thehealthbenefits of rambutan peel are closely related to its nutri-chemical composition, particularly its high levelsofnutrientsandbioactivecomponents.Inthisstudyfreshaswellasdriedrambutanpeel 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 constituentsislacking,thusanevaluationofnutrientandphytochemicalprofileofthepartsof 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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