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RAMBUTAN, A TROPICAL PLANT WITH ETHNO-PHARMACEUTICAL PROPERTIES

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Abstract
Rambutan has a long history not only as a delicious and succulent fruit, but also as a traditional medicine. Rambutan is a good source of natural sugars, potassium, calcium and magnesium, and it is also a modest source of fiber, and contains several B vitamins. Its seeds are bitter and narcotic, while its fruits considered astringent, stomachic, vermifuge and febrifuge. The fruit of rambutan is utilized for consumption, such as fresh fruit, canned fruit, juice, jellies, or jam. It contains of antioxidant, antibacterial, antidiabetic, antihyperlipidemic, anti-inflammatory, hepatoprotective, antiproliferative, biosorbent, antiadipogenesis properties. The most important traditional health benefits of rambutan consist of decreasing unwanted fat, source of iron, its usage in skin and hair care, it is rich in vitamin C, it improves sperm quality, it has anti-cancer characteristics. The obtained findings suggest potential of rambutan as a super-fruit with incredible pharmaceutical advantages.

Keywords: Rambutan, Traditional Medicine, Phytochemical properties.

INTRODUCTION

Rambutan occurrence and cultivation

Several plants are included in several traditional systems of medicine and they are promising bioactive compounds that retained their usefulness in the modern drug therapy (Ogbaji et al., 2018; Soleymani and Shahrajabian, 2018; Sun et al., 2019a,b). Traditional herbs and fruits have been used as traditional medicine immune booster for human being for thousands of years in China and other Asian countries (Shahrajabian et al., 2019a,b,c,d,e,f,g). Rambutan (*Nephelium lappaceum* L.) is a fruit of Sapindaceae family and is a native to tropical regions, such as Indonesia, China, India, Australia, Malaysia, Mexico and Thailand (Joo-Perez et al., 2017). The name for rambutan fruit is derived from the Malay-Indonesian word rambut which means hairy; this is the reason it is also named as hairy litchi (Morton, 1987). Its fruit is an ovoid berry, yellow to orange-red, or bright-red to maroon in color (Mahmood et al., 2018). It has the leathery skin of ca. 3 mm thickness, fully covered with spinterns of variable length (0.5-2.0 cm). The flesh is juicy and translucent whitish, sweet to very mild sour in flavor. The fruit core has an almond-line seed that is oblong, with dimensions of 2.5-3.4 cm length and 1.0-1.5 cm breadth (Morton,

1987). The diversity of species in the Nephelium genus in the world reaches 22 species, 16 species were found in Indonesia, and nine of them are the species of rambutan that are consumable, namely *N. lappaceum*, *M. cuspidatum* var. eriopetalum, *N. junglandifolium*, *N. maingayi*, *N. meduseum*, *N. ramboutan-ake*, *N. melanomiscum*, *N. reticulatum* and *N. uncimatum* (Windarsih and Efendi, 2019). Rambutan rapidly lose their attractive appearance after harvest due to a superficial pericarp browning; water loss precedes browning occurrence and it appeared to affect rambutan pericarpt tissue in much the same manner as senescence (Landrigan et al., 1996).

Rambutan nutritional composition and chemical constituents

Fila et al. (2012) revealed that the anti-nutritional components such as saponin, alkaloid, hydrocyanic acid, phenols, oxalate, tannis, phytates were detected in all the samples but at a varying tolerable concentration. But, other anti-nutrient constituents were in small insignificant amount in all the parts of the fruits, seeds and rind. Chigurupati et al. (2019) reported that the total phenolic, total flavonoid content of rambutan were expressed in terms of gallic acid and rutin equivalents, and the antioxidant assay revealed that rambutan exhibited significant inhibition of DPPH, and ABTS radicals, and it also inhibited both α-amylase, αglucosidase enzyme activities. Summarize the nutritional values of rambutan seed is presented in Table 1.

Main fatty acids in rambutan (*Nephelium lappaceum* Linn.) seed fat are shown in Table 2. Mineral composition of rambutan peel is presented in Table 3. Phytochemical analysis of *Nephelium lappaceum* epicarp methanolic extract is shown in Table 4. Physicochemical analysis of rambutan seed fat is presented in Table 5. Anti-nutrient contents of fresh and dried rambutan is shown in Table 6.

Table 1. Summarize the nutritional value of rambutan seed (*Nephelium lappaceum* L.).

Composition	Quantity
Fat	0.68%
Protein	0.91%
Nitrogen	0.14%
Ash	0.33%
Calcium	9.58 mg/100g
Iron	0.34 mg/100g
Magnesium	12.3 mg/100g
Manganese	1.06 mg/100g
Potassium	84.1 mg/100g
Sodium	20.8 mg/100g
Zinc	0.17 mg/100g
Phosphorus	16.6 mg/100g
pH	4.66
Vitamin A	< 40 IU/100g
Vitamin C	59.4 mg/100g
Sugar Profile	
Fructose	2.9%
Glucose	2.9%

Sucrose	11.4%
Maltose	<0.1%
Lactose	<0.1%
Total Sugars	17.2%
Riboflavin	0.050 mg/100g
Thiamin	<0.010mg/100g
fiber	0.05%

Table 2. Main fatty acids in rambutan (*Nephelium lappaceum* Linn.) seed fat (Issara et al., 2014).

Fatty acid	Average (%)
Palmitic	6.1
Palmitoleic	1.5
Stearic	7.1
Oleic	40.3
Arachidic	34.5
Gondoic	6.3
Behenic	2.9
Non-identify	1.2
SFA	50.7
MUFA	48.1

*SFA-saturated fatty acids; MUFA-monounsaturated fatty acids.

Table 3. Mineral composition (mg/l dry matter) of rambutan peel (Issara et al., 2014).

Mineral element	Rambutan husk
Cu	0.070±0.001
Mn	0.14±0.01
Fe	0.29±0.02
Zn	0.080±0.007
Mg	0.15±0.02
K	0.57±0.02
Na	0.04±0.01
Ca	0.51±0.01

Table 4. Phytochemical analysis of *Nephelium lappaceum* epicarp methanolic extract (Nethaji et al., 2015).

Phytochemicals	*Nephelium lappaceum* epicarp methanolic extract
Carbohydrates	Present
Alkaloids	Present
Steroids and sterols	Present
Glycosides	Present
Flavonoids	Present

Triterpenoids	Present
Tannins	Present
Proteins and amino acids	Present

Table 5. Physicochemical analysis of Rambutan Seed Fat (RSF) (Hajar et al., 2017).

Analysis	Value
Melting point	38.00±1.00- 48.83±1.61^{o}C
Refractive index	1.46±0.00
Total carotene content	1.18±0.06 mg/kg
Water activity	0.4721±0.0176
Acid value	1.2162±0.1520 mg KOH/g
Peroxide value	9.6000±0.4000g/g
Saponification value	146.8040±18.0182 mg KOH/g

Table 6. Anti-nutrient contents (mg/100g) of fresh and dried rambutan (*Nephelium lappaceum*) (Fila et al., 2012).

	Saponin	Alkaloid	HCN	Tannin	Phytate	Phenol	Oxalate	Flavonoids
FRP	1.50±0.00	0.00±0.00	0.00±0.00	0.12±0.00	0.15±0.01	0.11±0.00	0.11±0.00	7.64±0.01
FRS	0.98±0.01	0.82±0.01*	0.00±0.00	0.15±0.00	0.40±0.00*	0.20±0.00	0.26±0.01*	16.00±0.10*
FRP	0.53±0.01*	2.17±0.07*[a]	0.00±0.00	1.35±0.01*[a]	0.17±0.00[a]	0.31±0.01*	0.12±0.00*[a]	88.84±.02*[a]
DRP	3.18±0.21	0.00±0.00	0.00±0.00	0.35±0.01	0.71±0.00	0.36±0.07	0.07±0.00	3.27±0.67
DRS	2.10±0.05*	1.95±0.02*	0.00±0.00	0.28±0.01*	0.77±0.03*	0.41±0.09*	0.19±0.01*	1.63±0.32*
DRR	2.24±0.57	4.41±0.01*[a]	0.00±0.00	1.72±0.02*[a]	0.40±0.12*[a]	0.68±0.06*[a]	0.10±0.00[a]	22.30±0.30*

FRP= Fresh Rambutan Pulp; DRP= Dry Rambutan Pulp
FRS= Fresh Rambutan Seed; DRS= Dry Rambutan Seed
FRR= Fresh Rambutan Rind; DRP= Dry Rambutan Rind
Values are expressed as mean ± SEM, n=3
*p<0.05 vs pulp; a=p<0.05 vs seed

Medicinal uses and potential health benefits in traditional medicine and modern medicine industry

Mistriyani et al. (2018) found that rambutan peel exhibited strong antioxidant activities contained high amounts of phenolics and flavonoid and is potential to be developed as a function food. Hajar et al. (2017) indicated that Rambutan seed fat (RSF) contain high saturated fatty acid as the melting point was high, also with Refractive index (RI), the low of RI value, the higher saturated fat or single bond present. Carotene indicates the present of vitamin A and a powerful antioxidant. According to their results, RSF showed high industrial potential as cocoa butter replacement in chocolates and cosmetics production as the physicochemical properties of RSF is quite similar to cocoa butter. Chigurupati et al. (2019) announced that rambutan is traditionally claimed as a source of natural antioxidants and for its use in the treatment of diabetes and

bacterial infections. Soeng et al. (2015) discovered that antioxidant and hypoglycemic activity of rambutan 's seed (NLS) extract and fractions have high superoxide dismutase value (SOD) but low 1,1-diphenyl-2-picryl-hydrazyl (DPPH) scavenging activity and can be used as potential hypoglycemic agent. Widowati et al. (2015) stated that Rambutan peel extraction (RPE) showed comparable free radical scavenging activity with Geraniin and higher α- and β-glucosidases inhibitory activities than Geraniin, and RPE could be suggested as a promising antioxidant and anti-glycemic agent. Febrianto et al. (2014) also showed that rambutan fat has relatively good compatibility with cocoa butter when applied in concentration of 30% of below, resembling its capability and potential to be utilized as cocoa butter replacer which allows the mixing with cocoa butter in small ration, or it can be utilized in confectionery product other than cocoa butter-derived product. Yap et al. (2017) demonstrated that rambutan seed extracts have very high performance in removing iron and manganese in ground water and have the potential to be used as coagulant in water treatment. Lestati et al. (2018) found that rambutan peel extract (RPE) contains polyphenols, which can be used as anti-obesity agents. Both edible and nonedible parts of rambutan contain some components which are beneficial to human health such as geraniin, ellagic acid and corrilagin (Rohman, 2017). Ma et al. (2017) declared that rambutan peel phenolic (RPP) effectively protected the tissue structure of the liver, kidney and pancreas, and also RPP decreased the mesangial index and inhibited the expression of TGF-β in the kidney of diabetic mice. Mohd et al. (2014) confirmed that *Nephelium lappaceum* peel extract is an attractive candidate for the natural corrosion inhibitor. Sekar et al. (2014) showed that methanolic extract of yellow rambutan peels are good candidate for further investigation against gram positive bacteria. Rahayu et al. (2013) concluded that the rambutan seed infusion has an effect in reducing the blood glucose level and body weight of mice induced with alloxan tetrahydrate. Muhtadi et al. (2017) discovered that the gel nanoemulsion of the rambutan fruit peel extracts (RFPEs) of FIII had a good physical stability and sunscreen protection activity. The most important health benefits of rambutan is presented in Table 7. It has been reported that rambutan in traditional medicine use for centuries especially as a remedy for diabetes and high blood pressure (Sukmandari et al., 2017).

Table 7. The most important health benefits of rambutan.

It has Positive influence on diabetes treatment
It can prevent weight gain
It improves heart health
It enhances bone health
It may help prevent cancer
It has antibacterial and antiseptic properties
It boosts energy
It improves digestive health
It works as an aphrodisiac
It promotes scalp and hair health
It enhances skin health

CONCLUSIONS

Rambutan (*Nephelium lappaceum* L.) is a tropical fruit, and people consume the fruit. The

rambutan belongs to Sapindaceae family includes 125 genera and more than 1000 species of shrubs and trees. The rambutan is a medium-sized tree. Rambutan is an important commercial crop in Asia, where it is normally consumed fresh, canned or processed and appreciated for its refreshing flavor and exotic appearance. Rambutan fruit peel contains natural antioxidant, and also some phenolic compounds and flavonoids such as ellagic acid, corillagin, and geraniin. The rambutan fruit has been proven to possess phytochemicals that demonstrate anticancer, anti-allergic, anti-obesity, antidiabetic, anti-HIV, antimicrobial, anti-dengue, anti-hypercholesterolemic, and antihyperglycemic effects in varied in-vitro and in-vivo models. In summary, rambutan is a super-fruit which can promote good health as a modern medicine and treat diseases.

CONFLICTS OF INTEREST

Authors declare no conflict of interest.

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