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Nutritional and Chemical Composition of Jackfruit Rind Flour

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ABSTRACT

Background: Jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae.Two cultivars of jackfruit are popular in Kerala being “Koozha” and “Varikka” The rind of jackfruit is mostly thrown away or given to cattle. This issue has been addressed by processing the rind into flour and ascertaining its nutritional and chemical composition.

Methods: Mature jackfruits-Raw and ripe (cv varikka and koozha) with optimum maturity indices were selected from the instructional farm, College of Agriculture, Vellayani. They were cleaned, cut and immersed in pre treatment media and subjected to drying. The dried product was milled and packed in laminated pouches. They were subjected to quality analysis using standard procedures.

Result: The nutrient analysis of jackfruit rind flour showed significant differences among raw and ripened varikka and koozha rind flours. Raw Koozha jackfruit rind flour showed higher content of crude fiber (18 g/ 100 g) and dietary fiber (13.56 g/ 100 g). It had low content of carbohydrate (29 g/100 g) and fat (1.84 g/10 0 g). The chemical composition of raw koozha jackfruit rind flour had higher tannins (0.088 g/100 g). It also had higher content of polyphenols (2 g/100 g) that could be responsible for the enzymatic browning of rinds and had lower peroxide value (0.5 g/100 g), which could be the reason for better keeping quality of this rind type. Pectin content was found to be higher (27.5 g/100 g) in ripe varikka jackfruit rind flour.

Key words: Chemical composition, Jackfruit rind, Nutritional.

INTRODUCTION

The post-harvest losses in jackfruit is around 30-35% during the glut season (Lakshminarayan, 2017). Besides, Jackfruit (*Artocarpus heterophyllus* Lam.), produces large amount of residue, as its seeds and rinds (Krishna *et al*., 2006). Jackfruit rinds are usually thrown as residue by food processing industries and vendors. Based on report from the Ministry of Agricultural and Agro-Based Industry (Malaysia), production of 56,631 million tons of jackfruit in the year 2011 had increased production to 33,979 million tons of jackfruit rinds as end-products (Foo and Hameed, 2012).

The throwing of jackfruit rinds might cause environment pollution. Efficient utilization of jackfruit rinds can upgrade economic value of the jackfruit rinds and reduce the expenditure of waste disposal. In order to reduce the wastage and negative effect to the environment, beneficial components such as pectin of jackfruit rinds, can be extracted (Koh *et al*., 2014). The skin waste of jackfruit has been suggested for anaerobic bio hydrogen production (Krishna *et al*., 2006). This study aimed at developing a flour from the rind of jackfruit rind and evaluating its nutritional qualities.

Jackfruit rind is composed of hexagonal, conical carpal apices. It consists of essential nutrients such as carbohydrate, proteins, fiber, fat, vitamins and minerals (Elevitch and Manner, 2006). Fresh fruits contain nutritional and health promoting components, including minerals, antioxidant components, vitamins such as C, E and A, phytochemicals such as folates, glucosinolates, carotenoids, flavonoids and phenolic acids, lycopene, selenium and dietary fibers which are relatively low in calories (Murcia, 2009).

Jackfruit is rich in dietary fiber, which makes it a good bulk laxative. The fiber content helps to protect the mucous membrane of colon by decreasing exposure time and binding with the cancer-causing chemicals in the colon (Mondal *et al*., 2013). Rahman *et al*. (1995) stated that jackfruit acts as a laxative and relieves constipation due to high fiber content. It also cleans up the colon thus preventing from colon cancer.

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MATERIALS AND METHODS

Raw materials

Jackfruit cultivars *Koozhaand Varikka* were selected for the conduct of this study. The matured jackfruits were procured from the Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram.

Raw mature jackfruits of 90-105 days after fruit set, with optimum visible maturity indices were selected. Raw mature jackfruits are suitable for the better yield of jackfruit rind, as the thickness of the rind diminishes with ripening of the fruit. The thorns and outer skin of jackfruit were removed. Jackfruit rind was separated from the fruit and perianth. The thickness and weight of the rind was measured and the rind was cut into equal sized cubes of size 2 cm × 1.5 cm (length × breadth).

Processing of Jackfruit rind flour

Jackfruit rind flour was processed according to the method standardized by Feili (2014) as shown in Fig 1.

Nutritional and chemical composition of jackfruit rind flour

The nutrient and chemical constituents namely carbohydrate, protein, fat dietary fiber, crude fiber, starch, tannins, phenol, iron, polyphenols, flavonoids, pectin and lectin of the raw and ripened jackfruit rind flour were estimated in order to compare its nutritive value as per the following standard procedures (Table 1).

Total antioxidant activity

The total antioxidant activity of raw and ripened jackfruit rind flour was determined by phosphomolybdenum method, the antioxidant capacity was expressed as Ascorbic acid equivalent (AAE) by using the standard Ascorbic acid (Prieto, 1999).

RESULTS AND DISCUSSION

In this study, *koozha* jackfruit rind flour had lower carbohydrate and fat content of 29 and 1.84 g/ 100 g respectively. It indicates that *koozha* rind flour can be utilized in daily diets for health since it has low carbohydrate and fat. Protein was found to be high in ripened *koozha* jackfruit rind flour. The slight difference in the fat, protein and crude fiber content can be due to the cultivar of jackfruit used, place of origin, assessment methods *etc* (Table 2).

This present study further shows that crude fiber and dietary fiber were higher in raw *koozha* jackfruit rind flour and it also revealed that fiber content decreased with maturity of the fruit.

Polyphenols have a capacity to act as antioxidants through a number of mechanisms such as radical scavenging by H-donation, inhibition of chain initiation by donating electrons or by binding of transition metal ion catalysts. Polyphenols present in *koozha* jackfruit rind flour was higher (2 g/ 100 g) than *varikka* rind flour. It shows that depending on the cultivar of fruits, content of the polyphenols changes accordingly (Table 3).

Flavonoids prevent platelet stickiness and hence platelet aggregation (Gupta *et al*., 2011). In this study, as depicted in Table 3, flavonoid content was higher in ripened *koozha* jackfruit rind flour (0.65 g/ 100 g). This indicates that the flavonoid content of the fruit increases during ripening.

It is also seen that, tannin content was found to be higher in koozha rind flour and *koozha* based papad and crispies. Even though there are disadvantages of high tannin consumption, it has its positive effects that make amino acids available for absorption. Pectin content in this study was lower in raw *koozha* jackfruit rind flour and was found to be increasing on ripening of the fruit. Lectin content of raw and ripened jackfruits of both cultivars *koozha* and varikka had similar lectin content irrespective of its cultivar difference and maturity.

Peroxide value determines the quality of the flour and the product. Higher the peroxide value, higher is the spoilage. *Koozha* jackfruit rind flour had lower peroxide value (0.5 mEq/ kg) indicating its higher shelf-life of the flour. In this study, total anti-oxidant activity shows that, it was higher in ripened jackfruit rind flour than raw jackfruit rind flour (Fig 2).

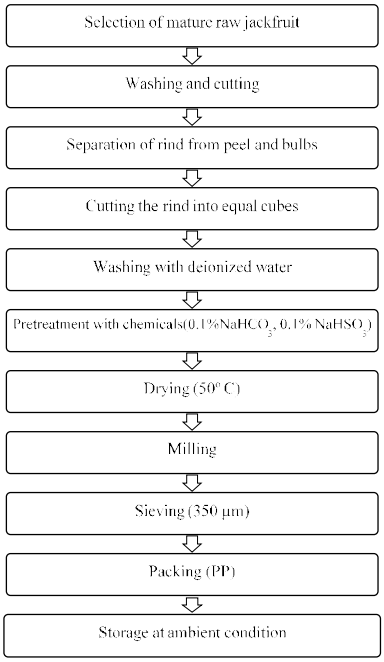

Fig 1: Flow diagram for preparation of jackfruit rind flour (JRF).

Table 1: Methods of analysis of nutrient and chemical composition of jackfruit rind flour.

Constituents	Method adopted
Moisture %	AOAC (1990)
Carbohydrate (g)	Sadasivam and Manikkam (1992)
Protein(g)	Bradford (1976)
Fat(g)	Sadasivam and Manikkam (1992)
Fiber (g)	Sadasivam and Manikkam (1992)
Starch (g)	Sadasivam and Manikkam (1992)
Total minerals(mg)	Thimmiah (1999)
Tannins	Sun (1988)
Total phenols	Waterhouse (2002)
Polyphenols	Waterhouse (2002)
Flavonoids	Lee (2012)
Lectin	AOAC (1990)
Pectin	AOAC (1990)
Iron	AOAC (1990)
Phosphorous	Hseu (2004)
Peroxide value	AOAC (1990)
Sodium	AOAC (1990)
Potassium	Harway and Heidal (1952)

Table 2: Nutrient composition of jackfruit rind flour (per 100 g).

Rind flour	Carbohydrates (g)	Protein (g)	Fats (g)	Crude fiber (g)	Dietary fiber (g)	Iron (µg/g)	Starch (g)	Ash (%)
KJRF	29^{d}	2.7^{b}	1.84^{d}	18^{a}	13.56^{a}	84^{a}	20.5^{b}	7.2^{b}
VJRF	45^{c}	1.2^{d}	2.74^{b}	15^{b}	12.89^{b}	15^{c}	19^{c}	7.98^{a}
RKJRF	63^{a}	4.8^{a}	3.8^{a}	12^{c}	12.11^{c}	25.5^{b}	25.5^{a}	6.98^{c}
RVJRF	55^{b}	2.2^{c}	2.7^{c}	11^{c}	11.35^{d}	25^{b}	25^{a}	6.45^{d}
CD (0.05)	1.888*	0.491*	0.182*	1.888*	0.182*	1.780*	0.944*	0.182*

(Results expressed are mean values of three replicates) *significant @ 5%

*Koozha*jackfruit rind flour (KJRF); Ripened *koozha* jackfruit rind flour (RKJRF); *Varikka* jackfruit rind flour (VJRF) Ripened *Varikka* jackfruit rind flour (RVJRF). Values denoted by different letters in the same column are significantly different (P<0.05).

Table 3: Chemical composition of jackfruit rind flour (per 100 g).

Rind flour	Total phenol (g)	Poly phenol (g)	Tannin (g)	Flavonoid (g)	Moisture (%)	Lectin (g)	Pectin (g)	Peroxide value (mEq/Kg)	Total Anti -oxidant activity (g)
KJRF	2^{a}	2^{a}	0.088^{a}	0.48^{ab}	1	0.32	14^{c}	0.5^{c}	0.3^{bc}
VJRF	0.6^{b}	0.15^{b}	0.016^{b}	0.373^{b}	0.5	0.31	16.5^{b}	2^{b}	0.263^{c}
RKJRF	0.58^{b}	1^{ab}	0.018^{b}	0.65^{a}	1.5	0.42	26.5^{a}	3.5^{a}	0.346^{ab}
RVJRF	0.7^{b}	0.2^{b}	0.019^{b}	0.34^{b}	1	0.43	27.5^{a}	4.0^{a}	0.376^{a}
CD (0.05)	0.182*	1.190*	0.005*	0.182*	NS	NS	1.888*	0.827*	0.095*

(Results expressed are mean values of three replicates) *significant @ 5%.

*Koozha*jackfruit rind flour (KJRF); Ripened *Koozha*jackfruit rind flour (RKJRF); *Varikka* jackfruit rind flour (VJRF) Ripened *Varikka* jackfruit rind flour (RVJRF); Values denoted by different letters in the same column are significantly different (P<0.05).

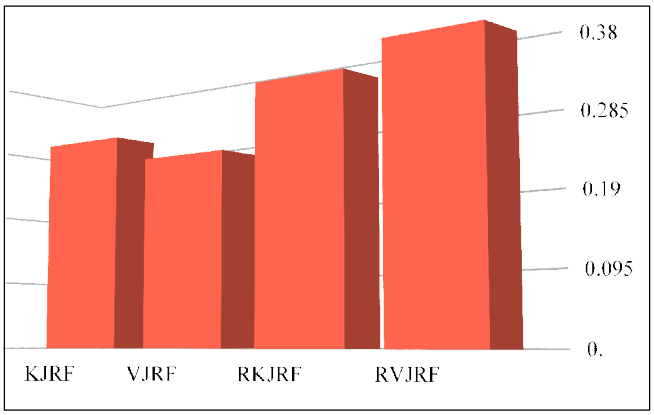

Fig 2: Total Anti-oxidant activity of Jackfruit rind flour.

*Koozha*jackfruit rind flour (KJRF); Ripened *Koozha*jackfruit rind flour (RKJRF); *Varikka* jackfruit rind flour (VJRF); Ripened *Varikka* jackfruit rind flour (RVJRF).

CONCLUSION

The nutrient analysis of jackfruit rind flour showed significant differences at 5% level, among raw and ripened varikka and koozha rind flours. Raw Koozha jackfruit rind flour showed higher content of crude fiber (18 g/ 100 g) and dietary fiber (13.56 g/ 100 g). It had low content of carbohydrate (29 g/ 100 g) and fat (1.84 g/100 g) which would suit diabetic patients.

The chemical composition of jackfruit rind flour showed significant differences at 5% level among raw and ripened varikka and *koozha* rind flours. Raw *Koozha* jackfruit rind flour had higher tannins (0.088 g/100 g) which could be the source of bitterness of the flour. It also had higher content of polyphenols (2 g/100 g) that could be responsible for the enzymatic browning of rinds and had lower peroxide value (0.5 g/100 g), which could be the reason for better keeping quality of this rind type. Pectin content was found to be higher (27.5 g/100 g) in ripe varikka jackfruit rind flour, which is a limiting factor in the production of dehydrated and extruded products as it affects the extrusion quality of the products.

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Conflict of interest: None.

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