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Profiling of Health and Nutritional Components in Jackfruit Variety - 'Muttomvarikka'

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ABSTRACT

Background: Jackfruit or 'panasa' scientifically known as *Artocarpus heterophyllus*. Lam belongs to the family Moraceae. *Artocarpus heterophyllus* Lam., is a tropical climacteric fruit and is native to Western Ghats of India and common in Asia, Africa and some regions in South America. It is known to be the largest edible fruit in the world. Jackfruit is rich in nutrients including carbohydrates, proteins, vitamins, minerals and phytochemicals. Both the seeds and the flesh of jackfruits are consumed as curries and boiled forms, while the flesh in fully ripened stage can be eaten directly as a fruit. This study was carried out to ascertain the bioactive compounds and nutrients present in the variety of jackfruit released by Kerala Agricultural University -Muttomvarikka.

Method: Raw bulb and seeds from fruits of 12 week maturity, along with manifestations like flattening of spikes, change from green to pale green, hollow sound, last leaf in the stalk turning yellow, were considered for selection. The analyses for nutritional and biochemical parameters were conducted using standard protocols.

Result: Muttomvarikka ripe seeds recorded higher content of protein (7.99 g) than raw seeds and bulbs. Fibre content of the samples revealed a range of 2.3% to 7.6%. Ripe bulb had higher beta carotene content (5.77 mg/g) than raw bulb and seeds. Carbohydrate content in seeds were higher than bulbs in both raw and ripe stages. Alkaloid content was higher in ripe bulbs and flavonoid content was higher in raw seeds; 19.32 mg of poly phenol was present in 100 g of ripe bulb, which was higher than raw stage. Antioxidant concentration was higher in koozha raw bulbs than ripe bulbs and seeds.

Key words: Alkaloids, Anti-oxidant activity, Bulb, Muttomvarikka, Seed, Total phenols.

INTRODUCTION

Jackfruit is an indigenous fruit crop of kerala in india and is widely grown as an important tree in kerala's homesteads. It is popularly known as the poorman's fruit. Growing on its own, without any chemical inputs, it has the potential to be identified as a therapeutic fruit grown organically. The greatest highlight of this fruit is that it is used as a vegetable, when raw and as a fruit when ripe. The State government had officially declared it as the official fruit of kerala, considering its spectrum of applications in the area of food and health security.

This fruit is one among the most ancient fruits indigenous to Western Ghats of India. It is a large edible summer fruit and is known to be the "Poor man's food" (Jagadeesh *et al*., 2007). Locally, jackfruit is known to be "Chakka" while Sanskrit refers it to be Panasa (synonym: Atibruhatphala which means big fruit) (Prakash *et al*., 2009). Jackfruit is a good source of nutritional and antioxidant compounds which hold their potential for nutraceutical development. These phytonutrients promote opportunities for manufacturing value-added products (Umesh *et al*., 2010) Research shows that compounds such as flavonoids and phenolics exhibit antioxidant properties (Rice Evans *et al*.,1996).

The 2 groups of jackfruits generally recognised among jackfruit treesin the state are, 'varikka' with firm bulbs and 'koozha' with soft bulbs and fibrous bulbs. Even among these, there are variations in characters with place and propagation practices.

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'Muttom' varikka is a jackfruit variety launched by the Kerala Agricultural University. The plants were produced by layering. The parent tree is reported to be selected from a locality called 'Muttom', of Alapuzha district of kerala, where there is a predominant population of varikka trees. Four young seedlings obtained from a single fruit of a parent were used for air layering anticipating varikka cultivators with satisfactory features. This experiment was conducted in 1967 after three months, one of the rooted layers were planted at College of Agriculture, Vellayani. The first female inflorescence emerged in 1970, when this tree was just 2 years and 4 months. At that time, the tree had attained a height of 7m and with a spread of 4 m. Six female flowers were produced, all of which set fruits and came to maturity. The fruits were harvested in august 1970.

Total weight - 7 kg, weight of bulbs - 3 to 6 kg, Length of fruit - 46 cm, width of fruit - 23 cm. The edible quantity of the

fruit was adjudged and found to be of good quality. The fruits were crisp, fleshy, non fibrous, sweet and golden yellow in colour. The fruit took 7-15 days to ripen and had good keeping quality. Trials on vegetative propogation gave 72% success and in layering 84% in arching with ordinary jack seedling used as stock (Srinivasan, 1970).

Thus by virtue of precocity and good edible quantities, 'Muttom'varikka ranks high as a pedigree jack tree.

Considering its nutritional and health benefits, there is need to promote this fruit for health and prevention of lifestyle diseases. Since systematic documentation of nutrient and chemical constituents is lacking, an evaluation of nutrient and phyto chemical profile of local varieties like this variety would enlighten the health conscious population, regarding the nutritive and health excellence of this fruit.

MATERIALS AND METHODS

Selection of Jackfruit-The variety Muttomvarikka was selected from the Instructional farm, College of Agriculture, Vellayani, Thiruvananthapuram for the study. Analyses of both the ripe and raw stages were undertaken. Seeds and bulbs were analysed separately.

Design - CRD.

Type - Muttomvarikka.

Stages - 2 (Raw and ripe).

Edible portion - 2 (bulbs and seeds).

Replication - 4.

Standard methods were used to estimate the bioactive compounds.

Constituent	Method
Carbohydrate	Hedge and Hofreiter (1962)
Protein	AOAC (2000)
Fibre	AACC (2000)
Carotenoid	AACC (2000)
Vitamin C	Sadasivam and Manickam (2008)
Sodium	Jaiswal (2003)
Potassium	AOAC (2005)
Alkaloid	Fazelshamsa *et al.* (2008)
Flavanoids	Lee *et al.* (2001)
Polyphenols	AOAC (2000)
Anti oxidant activity	AOAC (2000)

The results are presented herewith.

RESULTS AND DISCUSSION

Jackfruit exhibits huge variation in fruit size, shape, pulp, colour, taste, aroma and total soluble solids.Among them variation in pulp colour arethe main criteria for commercial exploitation of the genotypes. Tiwari and Vidyarthi (2016) reported that ripe jackfruit is richer than apple, apricot, avocado and banana,in some minerals and vitamins.

The presence of a high percentage of starch in jackfruit perianth and seeds, as revealed from chemical and histological studies has raised interest in evaluating the maximum starch content with respect to maturity, variety and different climatic and agronomic conditions for finding out its probable utilization as a staple food. Low molecular weight carbohydrate of immature jack (10 to 12 weeks) and ripe (14 to 16 weeks) jackfruit were isolated (Rahman *et al*., 1999). Table 1 shows that raw seeds had higher content of Carbohydrate, Lowest content was seen in raw bulbs. The possibility of incorporating jackfruit seed starch as athickener and stabilizer in chili sauce has been investigated by Rengsutthi and Charoenrein (2011) The ability of jackfruit seedstarch to maintain the pH, titratable acidity and total soluble solids in chili sauce has been found when incorporated in1% level. As revealed by the study, jackfruit seed starch incorporated chili sauce has exhibited a superior quality when compared to chili sauce which was incorporated withcorn starch. Cereals bars with good sensory and nutritional properties have been developed by the incorporation of 11% jackfruit seed flour and 27% of dehydrated jackfruit pulp (Santos *et al*, 2011). Rahman *et al.* (1999) had reported that starch content of jackfruit gradually increased with maturity.

Protein content was significantly higher in ripe seeds (7.98 g). Vazhacharickal *et al*. (2015) reported that protein and carbohydrate concentration varied in seeds across india where some varieties contained 6.8% of protein in seeds. The protein content of seeds are seen to higher than bulbs, similar observations were reported by Bemmo *et al* (2023).

Crude fibre content was seen to be on par in raw bulbs and raw seeds. Higher content was seen in Ripe bulbs.The fibre content of jackfruit seeds was reported to be consistent when processed and was higher than some conventional seeds like African breadfruit (Joy *et al*., 2018). Ranasinghe *et al.* (2019) reported that fibre content of raw fruit bulb varied between 2.6-3.6 gm/100 and that of ripe bulb varied from 1.0-1.5 g/100 g. The composition of jackfruit is seen to vary with variety. Ong etal (2006) reported the fiber content of jackfruit to be 0.33-0.40 %,with no significant changes in different portions of the fruit at different ripening stages. Coronel (1983) has been reported that the fibre content of immature and ripe jackfruit is 2.6 and 0.8% respectively. Goswami *et al.* (2011) found slight variations in fibre content among the jackfruit fleshesin different varieties ranging from 0.5 to 0.9%.

Carotenoids are pigments responsible for the yellow-reddish colourof many foods and are related to important functions and physiological actions, preventing several chronic degenerative diseases. Six carotenoids were detected in the ripe jackfruit bulbs which included carotene $\alpha_1\beta_1$, β Zeacarotene, α zeacarotene, carotene epoxide and carotene (Defaria *et al*., 2009). In this study ripe bulbs had higher carotene content (5.77 µg) lowest content was seen in raw seeds. (Table 2). Significantly higher vitamin content was found in ripe bulbs (15.06 mg/100 g) similarly Vitamin C content of ripe bulbs were higher. Sclem *et al*. (2019) reported higher vitamin C content in 3 strains of jackfruit pulp to ranged from 30.44 to 30.66 mg/100 g Significant variation in sodium content was seen among the parts the highest being observed in raw bulb (182 mg/100 g).

Samaddar (1985) reported that that every 100 g of ripe flakes contained 287-323 mg potassium and 11-19 g carbohydrate.

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Mohammed *et al* (2019) reported that the most abundant mineral found in jackfruit seed powder was potassium (7.69 mg/g) followed by phosphorus (1.29 mg/g), magnesium (1.03 mg/g), calcium (0.41 mg/g) and sodium (0.05 mg/g). Joy *et al.* (2015) reported that potassium content of local jackfruit ripe bulb was reported as 330 mg, which is more or less similar to the potassium content of muttomvarikka.

Antioxidants are the compounds that are able to delay, retard or prevent oxidation process (Halliwell, 1997). It is seen from Table 3 that Muttom varikka ripe bulb and seed had higher level of antioxidants than the raw parts they protect thebody and biomolecules from the damage caused by genera-tion of excess free radicals. Jackfruit contains a wide rangeof phytonutrients such as carotenoids that can act as antioxi-dants (Baliga *et al*., 2011). Jagtap *et al*. (2010) state that the antioxidant activities of jackfruit flesh extracts are correlated with the totalphenolic and flavonoids content. According to Soong andBarlow (2004), fresh seed and flesh possess substantial ascorbicacid equivalent antioxidant effects and 27.7 and 0.9 gallicacid equivalent phenolic contents, which are believed to havecontributed to about 70% of the total antioxidant activity. Table 4 reveals that the alkaloid content varied from 15.67 µg to 41.65µg which was significantly different Flavanoid content was on par with raw and ripe bulbs, lowest content was observed ripe seeds, flavanoids are reported to be associated with anti-oxidant function (Talukdar *et al*., 2023). Significantly higher polyphenol content was observed in ripe bulbs.Highest

Table 1: Proximate composition of jackfruit bulbs and seeds of Muttomvarikka.

Nutrients	Jackfruit parts	Quantity	
Carbohydrate g/100 g	MVR_1B	31.60	
	MVR_1S	62.67	
	MVR_2B	32.60	
	MVR_2S	60.67	CD-0.186
Protein g/100 g	MVR_1B	1.62	
	MVR_1S	6.23	
	MVR_2B	1.47	
	MVR_2S	7.98	CD-0.021
Crude fibre (%)	MVR_1B	2.3	
	MVR_1S	3.2	
	MVR_2B	4.4	
	MVR_2S	2.3	CD-0.422

MVR_1B - Muttomvarikka raw bulb; MVR_1S - Muttomvarikka raw seed; MVR_2B - Muttomvarikka ripe bulb; MVR_2S - Muttomvarikka ripe seed.

Table 2: Vitamin and mineral content of jackfruit bulbs and seeds of Muttomvarikka.

Nutrients	Jackfruit parts	Quantity	
Carotenoid (µg/g)	MVR_1B	5.27	
	MVR_1S	1.27	
	MVR_2B	5.77	
	MVR_2S	1.97	CD-0.034
Vitamin C(mg/100 g)	MVR_1B	14.26	
	MVR_1S	7.26	
	MVR_2B	15.06	
	MVR_2S	6.02	CD-0.462
Sodium (mg/100 g)	MVR_1B	182.1	
	MVR_1S	102.5	
	MVR_2B	167.4	
	MVR_2S	10.4	CD-0.006
Pottassium (mg/100 g)	MVR_1B	252.7	
	MVR_1S	325.0	
	MVR_2B	374.7	
	MVR_2S	283.4	CD-0.021

MVR_1B - Muttomvarikka raw bulb; MVR_1S - Muttomvarikka raw seed; MVR_2B - Muttomvarikka ripe bulb; MVR_2S - Muttomvarikka ripe seed.

Table 3: Antioxidant composition in jackfruit bulbs and seeds of Muttomvarikka.

Nutrients	Jackfruit parts	Amount	
Total antioxidants (µg/g)	MVR_1B	45.33	
	MVR_1S	40.10	
	MVR_2B	52.13	
	MVR_2S	57.81	CD-1.980

MVR_1B - Muttomvarikka raw bulb; MVR_1S - Muttomvarikka raw seed; MVR_2B - Muttomvarikka ripe bulb; MVR_2S - Muttomvarikka ripe seed.

Table 4: Bioactive compounds in jackfruit bulbs and seeds of Muttomvarikka.

Nutrients	Jackfruit parts	Amount	
Alkaloids (µg/g)	MVR_1B	41.65	
	MVR_1S	39.21	
	MVR_2B	42.33	
	MVR_2S	15.67	CD-0.424
Flavanoids mg/100 g	MVR_1B	43.46	
	MVR_1S	49.26	
	MVR_2B	43.46	
	MVR_2S	23.95	
Polyphenol (mg/100 g)	MVR_1B	18.25	CD-0.11.02
	MVR_1S	17.25	
	MVR_2B	19.32	
	MVR_2S	2.14	CD-0.079

MVR_1B - Muttomvarikka raw bulb; MVR_1S - Muttomvarikka raw seed; MVR_2B - Muttomvarikka ripe bulb; MVR_2S - Muttomvarikka ripe seed.

antioxidant levels were observed in ripe seeds and lowest in raw seeds- 57.81 µg and 40.10 µg respectively. Polyphenols have a positive correlation with antioxidant activity, more is the amount of extracted polyphenols more is the antioxidant activity (Kajla *et al*., 2016). Pathak *et al*. (2017) reported that phenol was found to be positively correlated with flavonoid content.

CONCLUSION

Diversity of nutrients and secondary metabolities in this jackfruit variety shows that, it is functionally, nutritionally and medically important. There is need to utilize this ethnic fruit as a functional food and utilize its medicinal properties. Diversity of secondary metabolites present in the jackfruit shows that it is a functionally, nutritionally and medicinally important fruit. Such studies are essential for awareness among people for the proper use of jackfruit as a functional food and utilize the medicinal uses of jackfruit. An understanding of the indepth composition of this jackfruit variety, would substantiate its therapeutic potential and hence ensure its optimum consumption among the health conscious population.

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Conflict of interest

There is no conflict of interest in the methodology and results of this study.

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