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## Development and quality evaluation of jackfruit rind incorporated vermicelli Payasam

ATHIRA RAJ\*, SHARON, C.L., SEEJA THOMACHAN PANJIKKARAN., LAKSHMI, P.S., SUMAN, K.T., DELGI JOSEPH C. and SREELAKSHMI A. S.

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**ABSTRACT:** Jackfruit belongs to the family Moraceae. The rind of jackfruit is mostly thrown away or given to cattle. This issue can be resolved by processing the jackfruit rind into suitable food products and ascertaining its nutritional composition. In this study the jackfruit rind pulp with whole wheat flour were incorporated in varying percentage levels ranging from 10 per cent to 60 per cent for the preparation of vermicelli. Organoleptic and nutritional quality evaluation of vermicelli was done. The best treatment was selected through sensory evaluation using a score card with a nine-point hedonic scale. Based on organoleptic evaluation, the vermicelli prepared with 10 per cent jackfruit rind pulp and 90 per cent whole wheat flour had a maximum mean score of 8.56 for overall acceptability. The selected vermicelli had a moisture content of 6.91%, energy of 387.62 Kcal, carbohydrate content of 83.5 g per 100 g, protein content of 10.12 g per 100 g, fat content of 0.98 g per 100 g, and crude fibre content of 2.13 g per 100 g. On the other hand, the control vermicelli had a moisture content of 6.23%, energy of 388.43 Kcal, carbohydrate content of 84.94 g per 100 g, protein content of 11.2 g per 100 g, fat content of 0.91 g per 100 g, and crude fibre content of 1.92 g per 100 g. The use of unutilised jackfruit rind can be promoted and made available to the consumer in a ready to cook form throughout the year.

**Key words:** Jackfruit rind, nutritional qualities, sensory qualities, vermicelli

Jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae. Jackfruit is one of the most lucrative and essential underexploited native fruits of India. The compound fruit of jackfruit is made of three parts viz., bulb (30-32%), seeds (18%) and rind (5-55%). The total jackfruit production in India has been recorded to be around 2.04 million tons (NHB, 2015). In Kerala, during 2005-06 the area and production of jackfruit are 94902 hectares and 350 million numbers respectively. During 2019-20 area is 93209 hectares and production 286 million numbers; Thrissur has the highest jackfruit production (3621 Kg/Ha) followed by Trivandrum and Kasargod 3588 and 3396 Kg/Ha respectively (GOK, 2022). Out of this a significant part go as waste because of its highly perishable nature and seasonal glut.

India relishes a salient place on the pomological map of the world. The changing weather conditions of the country render desirable environment for

growing different types of fruits. However, post-harvest losses of fruits are more severe in developing countries than those in well developed countries. Large number of ripe jackfruits deteriorate quickly after harvesting due to a lack of post-harvest understanding, resulting in poor handling and insufficiency of hygienic practices and storage facilities in locations where they are processed and marketed. The overall losses from reape to the consumer point are as high as 30-40 per cent, which costs thousands of crores of rupees. Tropical fruits, which are now underexploited, have a most valuable role to play in fulfilling the demand for nutritious, exquisitely flavoured and pleasing natural foods of high therapeutic value (Ravani *et al.*, 2014).

Now a days, consumers are increasingly conscious about their health, they demand nutritional qualities along with taste and variety. Jackfruit rind is abundant in dietary fibre, which makes it a good bulk evacuant. Fibre content helps to prevent the

colon mucous membrane by depreciating exposure time of chyme and also by binding to cancer causing compounds in the colon.

Rind of jackfruit is generated as waste of many processing operations. There have been innumerable efforts to bring about value addition of raw and ripened jackfruit and is being popularised by technologies across the state, giving best value to the fruit, but the by-products like rind remains unutilised and are dumped to the environment. It is felt that, there is also immense scope through scientific interventions for finding alternate uses for the unutilized rind. Utilisation of jackfruit rind for the development of food products would be green technology, since it could figure out the waste disposal problem of residues along with providing important nutrients for health. If they can be commercially processed, it would diversify daily meals by adding attractive food items.

The demand of instant food mixes is increasing day by day, due to increase in urbanisation, breaking up of the traditional joint family system, time, convenience and changing lifestyles. Low calorie and high nutritious instant food mixes are most preferred by consumers (Karthi, 2015). There lies a great opportunity for non-traditional uses of jackfruit in the form of convenience foods like vermicelli. Developing acceptable products can reduce the wastage and make the jackfruit an economically profitable one. Keeping in view the above facts and also the market prospects of jackfruit based food products, the study was conducted to develop jackfruit rind based vermicelli *payasam* by using jackfruit rind and whole wheat flour with improved nutritional and organoleptic qualities.

## MATERIALS AND METHODS

### Collection of materials

The study was carried out in 2022 at Department of Community Science, College of Agriculture, Kerala Agricultural University, Thrissur, Kerala. For this study, raw jackfruit (*Koozha* type) was collected from households of Thrissur district and the ingredients were collected from the local market.

### Preparation of raw jackfruit rind pulp

Jackfruit rind pulp was prepared using a standard procedure (Haque *et al.*, 2015 and Feili, 2013) with some modifications as shown in Fig. 1. The raw jackfruit was washed and separated into rind and bulb. The rind was sliced and ground into fine paste.

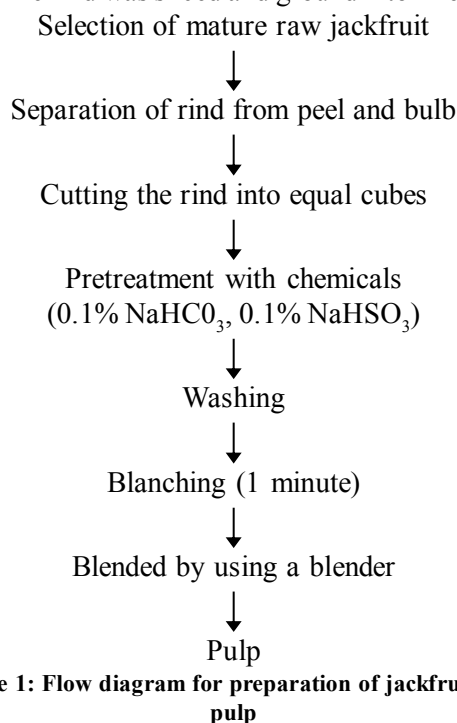


Figure 1: Flow diagram for preparation of jackfruit rind pulp

### Process standardisation of jackfruit rind based vermicelli

Vermicelli was prepared using standard procedure by Ranganna *et al.* (2014). The raw jackfruit rind pulp and whole wheat flour were mixed thoroughly and the dough was prepared with 30 per cent water in a dough mixer. The dough was kept for proofing for 30 minutes at room temperature. The prepared dough was extruded through manual extruder. The extruded vermicelli was dried at 55°C to 65°C in a cabinet drier for 4 to 5 hours. Preliminary trials were conducted to standardise the quantity of water required for the preparation of vermicelli.

For the development of jackfruit rind based vermicelli, treatments were tried using different combination of jackfruit rind pulp at the level of 10 to 60 per cent with 40 to 90 per cent whole wheat flour (T1- T6) and 0 to 20 per cent water as detailed

in Table 1. Treatment T0 whole wheat flour, served as control. The experiment was conducted in a Completely Randomised Design (CRD) with 7 treatment combinations and three replications.

### Preparation of jackfruit rind based vermicelli payasam

From the prepared Jackfruit rind-based vermicelli, *payasam* was prepared using the standard procedure (Ajisha *et al.*, 2018). *Payasam* were made with 200 g vermicelli, 2 proportion of milk and 3 proportion of sugar.

### Organoleptic evaluation

The sensory evaluation was carried out for the prepared vermicelli and *payasam* using nine point hedonic scale with a panel of 20 judges considering the six sensory parameters (appearance, colour, flavour, texture, taste and overall acceptability). Panel of twenty judges between age group of 18 to 35 years were selected by conducting a series of organoleptic trails using a simple triangle test at laboratory level as suggested by Jellinek (1985). Based on the organoleptic evaluation the best combination was selected for the further studies.

### Nutrient analysis

The nutritive qualities like moisture (A.O.A.C. 1980), carbohydrate, protein, fat and fibre (Sadasivam and Manickam, 1997) of best selected jackfruit rind-based vermicelli along with its control were determined.

### Moisture

To determine moisture content 10g of the sample was dried in a hot air oven at 60R° C to 70R° C,

**Table 1: Proportion of ingredients for jackfruit rind-based vermicelli**

Treatment	Combination	Amount of water (%)
T0	Control (100% WWF)	20
T1	90% WWF + 10%JRP	15
T2	80% WWF + 20% JRP	10
T3	70%WWF + 30% JRP	5
T4	60% WWF + 40% JRP	2.5
T5	50 % WWF + 50% JRP	–
T6	40% WWF + 60% JRP	–

(WWF – Whole wheat flour, JRP – Jackfruit rind pulp)

cooled in a desiccator and weighed. The process of heating and cooling was repeated till constant weight was achieved. The moisture content of the sample was calculated from the loss in weight during drying.

### Carbohydrates

A dried sample of 100mg sample was hydrolysed with 5ml of 2.5N HCl for 3 hours by boiling in water bath and cooled to room temperature. The residue was neutralized with sodium carbonate until effervescence ceases. The volume was made upto 100ml and centrifuged. An aliquot 0.2ml from the supernatant was pipetted out and made upto 1ml and then 4ml of anthrone reagent was added. Heated for 8 minutes in a boiling water bath, cooled rapidly and the intensity of green to dark colour was read at 630nm (OD) in spectrophotometer. A standard graph was prepared using standard glucose by applying the serial dilutions. From the standard graph, the amount of total carbohydrate present in the sample was estimated and expressed in gram per 100g of sample.

### Protein

A sample of 500mg was extracted using 5 to 10 ml of buffer (Tris buffer GR – tris hydroxymethyl amino methane) and centrifuged. An aliquot 0.1ml from the supernatant was taken in a test tube, 5ml alkaline copper solution were mixed well and allowed to stand for 10 minutes. Folin-Ciocalteu reagent of 0.5 ml was added and incubated at room temperature in the dark for 30 minutes and the developed blue colour was read at 660nm (OD) in spectrophotometer. A standard graph was prepared using alkaline copper solution and Folin- Ciocalteu reagent by applying serial dilutions. From the standard graph, the amount of total protein present in sample was estimated and expressed in gram per 100g of sample.

### Fat

Five gram of sample was taken in a thimble and plugged with cotton. The material was extracted with petroleum ether for six hours without interruption by gentle heating in a Soxhlet apparatus. Extraction flask was then cooled and ether was removed by

heating and the weight was taken. The fat content was expressed in gram per 100g of the sample.

### Fibre

Powdered vermicelli sample of two grams was boiled with 200 ml of 1.25 per cent sulphuric acid for 30 minutes. It was then filtered using muslin cloth and washed with boiling water. The residue was again boiled with 200 ml of 1.25 percent of sodium hydroxide for 30 minutes.

The filtration process were repeated using muslin cloth. After that, wash the residue with 25 ml of boiling 1.25% sulphuric acid, followed by three portions of 50 ml water and 25 ml alcohol. The obtained residue was taken in an ashing dish (W1) and dried at 130R” C for 2 hours. Cool the dish in a desiccator which was reweighed and noted as W2.

### Statistical analysis

The statistical analysis was carried out for the mean score obtained from sensory evaluation. The best treatment was identified from the interpretation of Kendall’s Coefficient of Concordance (W).

### Cost of production of jackfruit rind-based vermicelli

The cost of production of the most acceptable jackfruit rind-based vermicelli was computed based on the market price of procured ingredients used for preparation of product along with labour charge, fuel charge, electricity charge and packaging cost. The cost was calculated for 100 g of the product and compared with similar products available in the market.

## RESULTS AND DISCUSSION

### Organoleptic evaluation of jackfruit rind-based vermicelli

Jackfruit rind-based vermicelli incorporated with whole wheat flour were prepared in various proportion and compared with control (whole wheat flour) vermicelli. Based on organoleptic qualities, the mean score and the mean rank scores obtained for different sensory attributes of vermicelli prepared with jackfruit rind pulp in combination with wheat flour are presented in Table 2.

The mean score for appearance of jackfruit rind-based vermicelli (T1 to T6) ranged from 8.7 to 7.57 and for colour and flavour, the mean score varied from 8.45 to 7.45 and 8.53 to 7.07 respectively. Mean score for taste and texture varied from 8.47 to 6.83 and 8.67 to 7.26. Mean score for overall acceptability ranges from 8.56 to 7.27. The control vermicelli had mean score of 8.77, 8.65, 8.6, 8.67, 8.47, and 8.67 for appearance, colour, flavour, texture, taste and overall acceptability.

Among jackfruit rind-based vermicelli, the highest mean score for different quality attributes were noticed in vermicelli prepared with 10 per cent jackfruit rind pulp and 90 per cent whole wheat flour (T1), but it was found to be lower than whole wheat flour vermicelli (T0), the lowest mean score for different quality attributes was noticed for vermicelli prepared with 60 per cent jackfruit rind pulp and 40 per cent whole wheat flour (T6).

**Table 2: Mean score for organoleptic evaluation of jackfruit rind pulp incorporated vermicelli**

Treatments	Sensory parameters						Total score
	Appearance	Colour	Flavour	Texture	Taste	OverallAcceptability	
T0 (control )	8.77(5.70)	8.65(6.20)	8.6(5.80)	8.67(5.46)	8.47(5.93)	8.67(6.30)	51.83
T1 (90% WWF + 10%JRP)	8.7(5.40)	8.45(5.13)	8.53(5.57)	8.67(5.46)	8.47(5.93)	8.56(6.13)	51.38
T2 (80% WWF + 20% JRP)	8.57(4.80)	8.25(4.40)	8.23(4.50)	8.25(4.21)	8.1(4.77)	8.27(4.93)	49.67
T3 (70%WWF + 30% JRP)	8.43(4.43)	8.15(4.33)	8.13(4.33)	8.39(4.61)	7.9(4.07)	8.13(4.20)	49.13
T4 (60% WWF + 40% JRP)	8.1(2.67)	7.95(2.70)	7.8(3.0)	7.96(2.93)	7.7(2.90)	7.9(2.27)	47.41
T5 (50 % WWF + 50% JRP)	8.27(3.27)	8.06(3.37)	7.96(3.57)	8.17(3.64)	7.8(3.23)	8.07(3.07)	48.33
T6 (40% WWF + 60% JRP)	7.57(1.73)	7.45(1.87)	7.07(1.23)	7.26(1.29)	6.83(1.07)	7.27(1.10)	43.45
Kendall’s W	.611**	.587**	.647**	.680**	.773**	.851**	

(WWF – Whole wheat flour, JRP – Jackfruit rind pulp); Value in parantheses is mean rank score based on Kendall’s W; \*\*Significance at 1% level



Significant agreement (Kendall's value) among judges was observed for the different sensory parameters of vermicelli prepared using jackfruit rind pulp in combination with whole wheat flour.

Rao *et al.* (2021) developed jackfruit based little millet vermicelli, incorporating 5 to 15 per cent jackfruit flour in the little millet. Among the combinations, incorporation of 10 per cent jackfruit flour was selected as best based on the cooking quality, texture and the organoleptic properties. Escalano and Tabuac (2022) formulated noodles by substituting all purpose flour (APF) with green jackfruit rind and core flour (JRCF). In treatment 1, noodles formulated with 33 per cent JRCF and 67 per cent APF found to have highest mean score of 7.97 followed by treatment 2 (5 % JRCF + 50 % APF) with a mean score of 7.03, then treatment 3 (67% JRCF + 33% APF) with a mean score of 6.68.

#### Organoleptic evaluation of jackfruit rind based vermicelli *Payasam*

The mean core and mean rank scores obtained for different sensory attributes of *payasam* prepared with jackfruit rind pulp and whole wheat flour vermicelli are presented Table 3.

Among different treatments tried for the *payasam*, the highest mean score and mean rank score for appearance (8.36 and 5.33), colour (8.23 and 5.30), flavour (8.29 and 5.97), texture (8.22 and 5.87), taste (8.2 and 5.87) and overall acceptability (8.28 and 5.83) was recorded for T1 (10 per cent jackfruit rind pulp and 90 per cent whole wheat flour). The lowest

mean scores for quality attributes were noticed in *payasam* prepared with 60 per cent jackfruit rind pulp and 40 per cent whole wheat flour T6.

Significant agreement (Kendall's value) among judges was observed for the evaluation of different quality attributes of *payasam* prepared using jackfruit rind pulp and whole wheat flour-based vermicelli.

Ajisha *et al.* (2018)) standardised instant *payasam* mix from jackfruit based vermicelli with varying proportions of milk (1 L and 1.5 L) and sugar (100,125 and 150g). Among these treatments, the mean score for all the sensory attributes like appearance (8.62), colour (8.62), flavor (8.53), taste (8.64), texture (8.64) and overall acceptability (8.62) was highest in T6 (*payasam* prepared with 200g vermicelli, 1.5 L milk and 150 g sugar) than other treatments.

#### Nutrient analysis of the jackfruit rind based vermicelli *payasam*

Based on the sensory evaluation, the treatment T1 (10% JRP + 90% WWF) was found to be the best apart from control that is T0 (100% WWF). The nutritive value of selected jackfruit rind based vermicelli was observed to have moisture (6.91%), energy (387.62 Kcal), carbohydrate (83.5 g 100 g<sup>-1</sup>), protein (10.12 g 100 g<sup>-1</sup>), fat (0.98 g 100 g<sup>-1</sup>) and crude fibre (2.13 g 100 g<sup>-1</sup>) and control (T<sub>0</sub>) had moisture (6.23%), energy (388.43 Kcal), carbohydrate (84.94g 100 g<sup>-1</sup>), protein (11.12 g 100 g<sup>-1</sup>), fat (0.91 g 100 g<sup>-1</sup>), and crude fibre (1.92 g 100 g<sup>-1</sup>) as shown in Table 4.

**Table 3: Mean score for organoleptic evaluation of *payasam* prepared with jackfruit rind pulp incorporated vermicelli**

Treatments	Sensory parameters						Overall Acceptability	Total score
	Appearance	Colour	Flavour	Texture	Taste			
T0 (control)	8.58(6.70)	8.53(6.60)	8.44(6.50)	8.44(6.40)	8.51(6.73)	8.52(6.90)	51.02	
T1 (90% WWF + 10%JRP)	8.36(5.33)	8.23(5.30)	8.29(5.97)	8.22(5.87)	8.2(5.87)	8.28(5.83)	49.58	
T2 (80% WWF + 20% JRP)	8.16(4.37)	7.96(4.17)	7.89(4.23)	7.89(4.37)	7.73(4.23)	7.94(4.27)	47.57	
T3 (70%WWF + 30% JRP)	8(3.53)	7.84(3.83)	7.62(3.50)	7.71(3.90)	7.71(4.07)	7.78(3.77)	46.66	
T4 (60% WWF + 40% JRP)	8.02(3.70)	7.8(3.70)	7.8(4.17)	7.76(3.90)	7.6(3.57)	7.76(3.90)	46.74	
T5 (50% WWF + 50% JRP)	7.8(2.90)	7.53(2.87)	7.33(2.47)	7.27(2.57)	7.18(2.50)	7.42(2.30)	44.75	
T6 (40% WWF + 60% JRP)	7.18(1.47)	6.93(1.53)	6.33(1.17)	6.49(1.00)	6.47(1.03)	6.76(1.03)	40.16	
Kendall's W	.720**	.651**	.788**	.773**	.830**	.849**		

(WWF – Whole wheat flour, JRP – Jackfruit rind pulp), Value in parentheses is mean rank score based on Kendall's W

\*\*Significance at 1% level

**Table 4. Nutritional qualities of jackfruit rind-based vermicelli**

Treatments	Energy (Kcal)	Protein (g/100 g)	Fat (g/100 g)	CHO(g/100 g)	Crude Fibre (%)	Moisture (%)
T0(100% WWF)Control	388.43	11.2	0.91	84.94	1.92	6.23
T1(10% JRP + 90% WWF)	387.62	10.12	0.98	83.5	2.13	6.91
t value	4.27**	3.09**	23.78*	3.46**	3.84**	3.41**

JRP- Jackfruit rind pulp, WWF- Whole wheat flour, \*\*significance level at 5% and \*significance level at 1%

Jackfruit rind consists of essential nutrients such as carbohydrate, proteins, fibre, fat, vitamins and minerals (Elevitch and Manner, 2006). Tharani and Divakar (2022) reported that raw *Koozha* jackfruit rind flour had higher content of crude fibre (18 g/100g) and dietary fibre (13.56 g/100g). It had low content of carbohydrate (29g/100g) and fat (1.84 g/100g). It indicates that *koozha* rind flour can be utilised in daily diets for health since it has low carbohydrate and fat.

Ajisha *et al.* (2018) formulated jackfruit based vermicelli mixing raw jackfruit flour and jackfruit seed flour. Vermicelli prepared with roasted jackfruit flour and roasted jackfruit seed flour (70:30) had good nutritional profile and contained 63.7g 100g-1 of carbohydrate, 3.4g 100g-1 of protein, 0.80g 100g-1 of fat and 3.9g 100g-1 of fibre.

Jackfruit rind is rich in dietary fibre, which makes it a good bulk laxative. The fibre 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). Koh *et al.* (2014) found that the carbohydrate content in jackfruit rind was only 5.92 per cent.

#### The cost of production

The cost of jackfruit rind-based vermicelli was Rs. 97/ Kg. A study done by Ajisha *et al.* (2018) was found that the cost for jackfruit vermicelli was Rs.83/Kg.

The market price of whole wheat-based vermicelli was observed as Rs. 115/Kg. The cost of prepared jackfruit rind vermicelli was lower compared to the market price of other vermicelli.

#### CONCLUSION

Vermicelli and *payasam* prepared with whole wheat

flour and jackfruit rind pulp (90:10) were acceptable in all the sensory qualities and have good nutritional profile. With the demand for existing resources increasing, there has been a deliberate attempt to convert jackfruit byproducts into value added products. Jackfruit rind can be used to formulate variety of value-added products that includes, chips, papads, cookies, bread, biscuit, meat analogue and jellies. The use of unutilized jackfruit rind can be promoted by making it available to the consumer in a ready to cook form throughout the year.

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