

DEVELOPMENT AND EVALUATION OF RAW JACKFRUIT AND JACKFRUIT SEED BASED INSTANT *Payasam* MIX

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ABSTRACT

Jackfruit, the world's largest tree borne fruit, considered as a wonder fruit due to its nutritional profile and health promoting factors. Jackfruit seeds can be relished as a nutritious nut. However most of the fruits are wasted due to lack of processing units and marketing facilities. The present study was conducted to develop jackfruit based instant vermicelli *payasam* mix by using raw jackfruit flour and jackfruit seed flour. Based on organoleptic evaluation, mean score was high for vermicelli and *payasam* prepared with 70 % raw jackfruit flour and 30 % jackfruit seed flour, where 100% refined wheat flour served as control. The mean scores for overall acceptability of vermicelli and *payasam* was 8.31 and 8.4 respectively. The nutritive value of selected jackfruit based vermicelli observed to have moisture (7.62%), carbohydrate (63.03g 100g⁻¹), protein (3.78g 100g⁻¹), fat (1g 100g⁻¹), fibre (3.13g 100g⁻¹), calcium (49.27mg 100g⁻¹), iron (6.46mg 100g⁻¹), sodium (17.39mg 100g⁻¹) and potassium (238.5mg 100g⁻¹). An instant *payasam* mix was prepared with 200g of selected jackfruit vermicelli, 150g of sugar, 10g toasted cashew nuts and raisins, and 5g crushed cardamom. *Payasam* was prepared by cooking the ingredients in 1.5 liters of milk for 5 minutes. The instant *payasam* prepared had a mean score of 8.51 for overall acceptability. The cost of production of jackfruit based instant *payasam* mix was Rs 235/Kg.

KEYWORDS: Raw Jackfruit, Vermicelli, Jackfruit Seed Flour, Sensory Evaluation, Nutritive Value, Instant *Payasam* Mix

Jackfruit (*Artocarpus heterophyllus Lam.*) is an integral crop component of homestead farming and bears the largest fruit among the edible fruits. It is a popular fruit consumed in the tropics. It is widely grown in India, Bangladesh, South East Asia and West Africa (APAARI, 2012). Among the fruit crops seen in Kerala, jackfruit has a prominent position, which comes to 89702 hectares as reported in Farm Guide (2014). Raw jackfruit is composed of nutritional and health promoting substances, especially minerals, antioxidant compounds, vitamins, folates, phytochemical components, dietary fibres and has relatively low calories (Murcia, 2009). It is one of the rare fruit, rich in B-complex group of vitamins such as pyridoxine, niacin, riboflavin, and folic acid. However the fruit is perishable and cannot be stored for long time because of its inherent compositional and textural characteristics. Every year considerable amounts of jackfruit are wasted due to lack of processing units and marketing.

Jackfruit seeds make up around 10- 15 per cent of the total fruit weight. Jackfruit seed is used occasionally as a minor supplement in culinary preparations, but greater portion is wasted. Jackfruit seed is considered as cheap non-conventional protein source, so it can be used for the prevention of malnutrition in developing countries like India (Chowdhury *et al.*, 2012). Azeez *et al.* (2015) reported that the essential amino acids, fatty acids and trace amount of sugars present in jackfruit seeds make it a cheap source of dietary nutrients and health snack for

overweight people. Carbohydrate, protein and fibre are the major constituents of seeds and these nutrients interact with each other during product development and play an important role in determining the final quality of the food products. As jackfruit seeds are bland in taste with no unique flavour, there is potential opportunity for utilising the seed in the form of flour for value addition in the industrial sector (Rajarajeshwari and Jamuna, 1999).

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. *Payasam* mix is a most common food item which consists of roasted vermicelli along with toasted raisins and cashew nuts, mixed with other ingredients, packed in polypropylene bags (Srinivasan and Nirmala, 2014). Developing acceptable products can reduce the wastage and make the jackfruit an economically profitable one. Hence, the present study was conducted to develop jackfruit based instant vermicelli *payasam* mix by using raw jackfruit flour and jackfruit seed flour with improved nutritional and organoleptic qualities.

MATERIALS AND METHODS

Procurement Of Raw Materials

Raw jackfruit (*koozha* type) was collected from the households and the raw jackfruit flour and jackfruit seed flour was prepared as per the procedures (Pandey, 2004 and Kumari, 2015). Refined wheat flour, milk, sugar, cardamom, raisins and cashew nuts were procured from the local market.

Preparation Of Raw Jackfruit Bulb And Seed Flour

The raw jackfruits were washed and separated into bulbs and seeds. The bulbs were sliced into 2.5×1 cm and then blanched in boiling water for one minute. The blanched slices were cooled and immersed in 0.2 per cent KMS solution for 10 minutes. The immersed slices were then dried in a cabinet drier at 60°C for 12 hours. The dried chips were milled into flour and sieved through 0.5 mm mesh to get uniform flour.

Jackfruit seeds were cleaned and the white arils were peeled off manually. It was then washed thoroughly in running water and subjected to thermal treatment (pressure cooked for 20 minutes) to inactivate anti-nutritional factors. Spermoderm layer was removed by rubbing the seeds between hands. The sliced seeds were dried (60°C for 12 hours) and powdered.

Preparation Of Vermicelli

Jackfruit based vermicelli was prepared in different combination as detailed in Table 1. Treatment T₀ refined wheat flour, served as control.

Table 1: Treatments for jackfruit incorporated vermicelli

| Treatments | Combinations |
|----------------|---|
| T ₀ | Control (100% refined wheat flour vermicelli) |
| T ₁ | 70% RJF + 30% JSF |
| T ₂ | 60% RJF + 40% JSF |

(RJF- Raw jackfruit flour, JSF – Jackfruit seed flour)

Sensory Evaluation

The sensory evaluation was carried out for the prepared vermicelli and *payasam*, using a nine point hedonic scale with a panel of 15 judges considering the 6 sensory parameters such as appearance, colour, flavor, texture, taste and overall acceptability.

Nutrient Analysis

The nutritive qualities like moisture (A.O.A.C. 1980), carbohydrate, protein, fat, fibre (Sadasivam and Manickam, 1997), calcium, iron (Perkin– Elmer, 1982), sodium and potassium (Jackson, 1973) of best selected jackfruit based vermicelli was determined initially and during the second and fourth month of storage.

Standardisation Of Instant *Payasam* Mix

From the selected jackfruit based vermicelli, instant *payasam* mix was standardised with 200g vermicelli with 2 proportions of milk and 3 proportions of sugar (Table 2) based on organoleptic qualities. In all treatments 10g toasted cashew nuts and raisins, and 5g crushed cardamom was added.

Table 2: Treatments for the standardisation of instant *payasam* mix

| Treatments | Milk (litre) | Sugar (g) |
|----------------|--------------|-----------|
| T ₁ | 1 L | 100g |
| T ₂ | 1 L | 125g |
| T ₃ | 1 L | 150g |
| T ₄ | 1.5 L | 100g |
| T ₅ | 1.5 L | 125g |
| T ₆ | 1.5 L | 150g |

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). Nutritional qualities of vermicelli during storage was analysed based on relative change over the previous month of storage.

Cost Of Production Of Jackfruit Vermicelli Instant *Payasam* Mix

The cost of production of the most acceptable combination of jackfruit vermicelli *payasam* mix was computed based on the market price of procured ingredients used for preparation of products along with labour charge, fuel charge, electricity charge and packaging cost. The cost was calculated for 1Kg of the product and compared with similar products available in the market.

RESULTS AND DISCUSSION

The mean score and the mean rank scores obtained for different sensory attributes of vermicelli and *payasam* prepared with raw jackfruit flour in combination with jackfruit seed flour and control are presented in Table 3 and 4. The result of organoleptic evaluation concluded that vermicelli and *payasam* prepared with 70 per cent jackfruit flour and 30 per cent jackfruit seed flour (T₁) had high mean score for appearance (8.4 and 8.35), colour (8.35 and 8.37), flavor (8.33 and 8.31), texture (8.26 and 8.33), taste (8.2 and 8.4) and overall acceptability (8.31 and 8.4). Compared to control (T₀), mean score for all sensory parameters of jackfruit based vermicelli (except appearance) and *payasam* was lower, but had a score above 8 out of 9. Significant agreement (Kendall's value) among judges was observed for the different quality attributes of vermicelli and *payasam* prepared using raw jackfruit flour and jackfruit seed flour vermicelli.

These results are similar with the findings of Faridah and Aziah (2012), they developed a low calorie cake incorporated with jackfruit seed flour (18 per cent) and wheat flour. The prepared product was highly acceptable for sensory qualities. Twenty five per cent incorporation of jackfruit seed flour bread showed good sensory qualities with a score of 7.65, 7.62, 7.42 and 7.15 for colour, flavour, texture and overall acceptability. Cake with jackfruit seed flour (20 to 25 % replacement of wheat flour) was best on overall acceptability. Increase in the substitution of seed flour results decrease in colour, flavour, texture, taste and overall acceptability of the prepared product (Aziah, 2012). Abraham and Jayamuthunagai (2014) observed that the firmness of pasta increased with the addition of jackfruit seed flour. Ten per cent jackfruit seed flour substituted pasta showed greater consumer acceptability, in relation to flavour, mouth feel, appearance, colour and overall quality.

Table 3: Mean scores for organoleptic evaluation of vermicelli prepared with jackfruit flour and jackfruit seed flour

| Treatments | Sensory parameters | | | | | Overall Acceptability |
|---------------------------------|--------------------|-------------|-------------|-------------|-------------|-----------------------|
| | Appearance | Colour | Flavour | Texture | Taste | |
| T ₀ (control) | 8.37 (1.97) | 8.44 (2.20) | 8.33 (2.07) | 8.42 (2.30) | 8.46 (2.50) | 8.4 (2.33) |
| T ₁ (70%RJF: 30%JSF) | 8.4 (2.17) | 8.35 (2.30) | 8.33 (2.07) | 8.26 (2.00) | 8.2 (1.90) | 8.31 (2.33) |
| T ₂ (60%RJF: 40%JSF) | 8.22 (1.87) | 8.31 (1.17) | 8.26 (1.87) | 8.22 (1.70) | 8.04 (1.60) | 8.02 (1.43) |
| Kendalls W | .029** | .064** | .020** | .275** | .123** | .275 |

(RJF - Raw jackfruit flour, JSF- Jackfruit seed flour)

Value in parentheses is mean rank score based on Kendall's W

**Significance at 1 % level

Table 4: Mean scores for organoleptic evaluation of *payasam* prepared with jackfruit flour and jackfruit seed flour vermicelli

| Treatments | Sensory parameters | | | | | Overall Acceptability |
|---------------------------------|--------------------|-------------|-------------|-------------|-------------|-----------------------|
| | Appearance | Colour | Flavour | Texture | Taste | |
| T ₀ (control) | 8.62 (2.43) | 8.62 (2.70) | 8.46 (2.33) | 8.6 (2.43) | 8.57 (2.50) | 8.71 (2.57) |
| T ₁ (70%RJF: 30%JSF) | 8.35 (2.07) | 8.37 (1.87) | 8.31 (2.20) | 8.33 (1.90) | 8.4 (2.27) | 8.4 (2.07) |
| T ₂ (60%RJF: 40%JSF) | 8.00 (1.50) | 8.22 (1.43) | 8.11 (1.47) | 8.22 (1.67) | 8.02 (1.23) | 8.12 (1.37) |
| Kendalls W | .340** | .488** | .267** | .185** | .593** | .484** |

(RJF - Raw jackfruit flour, JSF- Jackfruit seed flour)

Value in parentheses is mean rank score based on Kendall's W

**Significance at 1 % level

Nutrient Analysis

Table 5: Nutrient analysis of jackfruit flour and jackfruit seed flour vermicelli (60:30 ratio)

| Nutrients (100 g ⁻¹) | Initial | Second month | Fourth month |
|----------------------------------|---------|---------------|---------------|
| Moisture (%) | 7.62 | 7.64 (0.26) | 7.67 (0.39) |
| Carbohydrate (g) | 63.03 | 62.43 (0.95) | 61.15 (2.05) |
| Protein (g) | 3.78 | 3.69 (2.38) | 3.66 (0.81) |
| Fat (g) | 1.00 | 0.90 (10) | 0.86 (4.4) |
| Fibre (g) | 3.13 | 3.05 (2.44) | 2.93 (4.03) |
| Calcium (mg) | 49.27 | 49.15 (0.24) | 48.99 (0.32) |
| Iron (mg) | 6.46 | 6.44 (0.27) | 6.29 (2.63) |
| Sodium (mg) | 17.39 | 17.28 (0.63) | 17.09 (1.09) |
| Potassium (mg) | 238.05 | 237.00 (0.62) | 234.25 (1.16) |

(Figure in parentheses indicates per cent relative change over the previous month)

Moisture is an important parameter of quality determination in food products. The products with low moisture content have enhanced shelf life quality by lowering the microbial load (Abraham and Jayamuthunagai, 2014). From table 5, it is clear that moisture content of jackfruit based vermicelli was 7.6 per cent, found to be low compared with the results of Ritthiruangejet *et al.* (2011) who prepared noodles with raw banana flour and the moisture content was 8.67 per cent. The moisture content increased during storage period may be due to relative humidity and atmospheric temperature. The formulated vermicelli contains 63.03g 100g⁻¹ of carbohydrate, 3.78g 100g⁻¹ of protein, 1g 100g⁻¹ of fat and 3.13g 100g⁻¹ of fibre. The jackfruit based vermicelli had calcium, iron, sodium and potassium of 49.27mg 100g⁻¹, 6.46 mg 100g⁻¹, 17.39mg 100g⁻¹ and 238.50mg 100g⁻¹ respectively. Kumari (2015) developed raw jackfruit based noodles by mixing refined flour, raw bulb flour and jackfruit seed flour at different proportions. The results of study indicated that samples of jackfruit bulb flour and jackfruit seed flour added noodles contained more protein, fibre and minerals and was less in energy and carbohydrate as compared to control (refined wheat flour noodles) sample. Nandkule *et al.* (2015) reported that 20 per cent incorporation of jackfruit seed flour noodles have the fibre content of 1.6g 100g⁻¹. The nutrients are significantly decreased during fourth month of storage. The decrease in carbohydrate, protein and fat content during storage could be attributed to the degradation of polysaccharides, dissociation of protein into amino acids, lipolytic activities of the enzymes *lipase* and *lipoxidase*, and decomposition of complex molecule into simple

sugars (Murugkar and Jha, 2011). Mineral content decreased on storage may due to the utilisation of nutrients for the growth and multiplication of microbes present in food products (Sunday and Dayo, 2012).

Standardisation of Instant *Payasam* Mix

The mean scores of organoleptic evaluation for the prepared instant *payasam* are presented in table 6. From the various treatments tried for the standardisation of instant *payasam* mix, the treatment T₆ (*payasam* prepared with 200g vermicelli, 1.5 L milk and 150 g sugar, 10g toasted cashew nuts and raisins, and 5g crushed cardamom) obtained a highest mean score for appearance (8.46), colour (8.37), flavour (8.42), texture (8.48) taste (8.44) and overall acceptability (8.51). The cooking time of instant *payasam* was 5 minutes. Jha *et al.* (2000) prepared ready cook instant *kheer* mix with rice flour, milk powder and sugar, and packed in laminated pouches for 6 months. They found that formulated *kheer* mix had an optimum cooking time of 10 minutes. Divakar *et al.* (2014) developed instant banana based *payasam* mix which can be reconstituted with 950 ml of coconut milk, 300 g of sugar, and 10g of cashew nuts, raisins and sago. The prepared *payasam* was highly acceptable in terms of colour (4.88/5), mouth feel (4.92/5), taste (5/5), flavour (4.9/5) and overall acceptability (4.9/5). Shahanas *et al.* (2017) prepared jackfruit based instant pudding mix from 40g of raw jackfruit flour, 60g of corn flour, 75g of skimmed milk powder, 75 g of sugar and 2.5 g of thickening agent. The prepared pudding mix was highly acceptable with a mean score of 8.97.

Instant *payasam* mix was packed in laminated pouches. Each pouch consists of 200g of roasted jackfruit based vermicelli, 150g of sugar, 10g of toasted cashew

nuts and raisins, and 5g crushed cardamom. The time of cooking (5 minutes) and quantity of milk (1.5L) for the *payasam* preparation specified on the pouch.

Table 6: Mean scores for jackfruit and jackfruit seed flour based instant *payasam* mix

| Treatments | Sensory parameters | | | | | |
|------------------------------------|--------------------|-------------|-------------|-------------|-------------|-----------------------|
| | Appearance | Colour | Flavor | Texture | Taste | Overall Acceptability |
| T ₁ – 1 L M + 100 g S | 6.26 (1.70) | 6.55 (1.67) | 6.62 (1.57) | 6.4 (1.80) | 6.53 (1.87) | 6.37 (1.50) |
| T ₂ – 1 L M + 125 g S | 6.31 (1.80) | 6.68 (2.07) | 7.08 (3.10) | 6.48 (2.00) | 6.62 (2.00) | 6.71 (2.17) |
| T ₃ – 1 L M + 150 g S | 6.64 (2.53) | 6.8 (2.40) | 6.66 (1.97) | 6.6 (2.33) | 6.84 (2.50) | 6.88 (2.60) |
| T ₄ – 1.5 L M + 100 g S | 7.77 (4.20) | 7.8 (4.50) | 7.71 (4.00) | 7.88 (4.50) | 7.62 (4.07) | 7.71 (4.10) |
| T ₅ – 1.5 L M + 125 g S | 8.24 (5.20) | 4.83 (8.04) | 7.93 (4.60) | 8.04 (4.83) | 7.88 (4.77) | 8.11 (4.90) |
| T ₆ – 1.5 L M + 150 g S | 8.46 (5.57) | 8.37 (5.53) | 8.42 (5.77) | 8.48 (5.90) | 8.44 (5.80) | 8.51 (5.73) |
| Kendalls W | .255** | .499** | .393** | .481** | .655** | .538** |

(M – Milk, S – Sugar)

Value in parentheses is mean rank score based on Kendall's W

** Significant at 1% level

Cost Of Jackfruit Based Instant *Payasam* Mix

The cost of jackfruit vermicelli based instant *payasam* mix was Rs 235/Kg. The market price of wheat vermicelli, ragi vermicelli, and wheat based instant vermicelli *payasam* mix was observed as 165 Rs/Kg, 180 Rs/Kg and 500 Rs/Kg respectively. The cost of prepared *payasam* mix was lower compared to the market price.

CONCLUSION

Jackfruit based vermicelli formulated with 60 per cent raw jackfruit flour and 30 per cent jackfruit seed flour was highly acceptable for organoleptic and nutritional qualities. From the study it was evident that an acceptable instant *payasam* mix can be prepared from jack fruit flour and jackfruit seed flour. Incorporation of underutilised fruits like jackfruit for the development of instant mixes increased the nutritive value and reduced the cost. The possibility of producing such novel products from jackfruit bring about an era of prosperity with the right mix of employment generation and profit.

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REFERENCES

A.O.A.C., 1980. Official and Tentative Methods of Analysis (13th Ed.). Association of Official Analytical Chemists. Washington. D.C., 1018p.
 Abraham A. and Jayamuthunagai J., 2014. An analytical study on jackfruit seed flour and its incorporation

in pasta. Res. J. Pharma. Biol. Chem. Sci., 5(2): 1597-1610.

APAARI [Asia-Pacific Association of Agricultural Research Institutions], 2012. Jackfruit Improvement in the Asia Pacific Region –A Status Report. Asia-Pacific Association of Agricultural Research Institutions, Bangkok, Thailand, 182p.

Azeez O.S., Lasekan O., Jinap S. and Sulaiman R., 2015. Physico-chemical properties of amino acid profile and antinutritional factors in seeds of three Malaysian grown jackfruit cultivars. J. Food Agric. Environ., 13(2):58-62.

Aziah N.A., 2012. Organoleptic and physiochemical evaluation of bread supplemented with jackfruit seed flour. Asian Food J., 14(2): 123-130.

Chowdhury A.R., Bhattacharya A.K. and Chattopudhyay P., 2012. Study on functional properties of raw and blended jackfruit seed flour for food application. Indian J. Nat. Products Resour., 3(3):94-99.

Divakar S., Ukkuru M. and Krishnaja U., 2014. Development of a banana-based “*payasam* mix”. Stud. Home Com Sci., 8(1):41-43.

Faridah S. and Aziah N. A., 2012. Development of reduced calorie chocolate cake with jackfruit seed flour and poly dextrose using response surface methodology. Int. Food J., 19(2): 515-519.

- Farm Guide, 2014. Area under crops 2012-13, Farm Information Bureau, Government of Kerala, 339p.
- Jackson M.L., 1973. Soil Chemical Analysis. Prentice Hall of India Private Ltd, New Delhi, 299p.
- Karthi B., 2015. Consumer attitude and behavior towards the instant noodles especially Maggi in India. EPRA Int. J. Econ. Rev., **3**(11): 212-217.
- Kumari V., 2015. Development of noodles from raw jackfruit. M. Sc (Home Science) thesis, Kerala Agricultural University, Vellayani, Kerala, 168p.
- Murcia M.A., 2009. Antioxidant activity of minimally processed (in modified atmospheres), dehydrated and ready to eat vegetables. Food Chem. Toxicol., **47**:2103-2110.
- Murugkar D.A. and Jha K., 2011. Influence of storage and packaging conditions on the quality evaluation of sensory attributes biscuits developed using single and multiple blend nutraceuticals. Int. J. Pure App. Biosci., **5**(2):433-440.
- Nandkule V.D., Masih D., Sonkar C., Devendrasing D. and Patil D.D., 2015. Development and quality evaluation of jackfruit seed and soy flour noodles. Int. J. Sci. Eng. Technol., **3**(3): 802-806.
- Pandey S., 2004. Value added products and by products from jackfruit, Ph. D. (Home Science) thesis, Kerala Agricultural University, Kerala, 308p.
- Perkin- Elmer, 1982. Analytical Methods for Atomic Absorption Spectrophotometry. Perkin- Elmer Corporation, USA, 114p.
- Rajarajeshwari H. and Jamuna P., 1999. Jackfruit seeds: composition, functionality and use in product formulation. Indian J. Nutr. Dietetics., **36**:312-319.
- Ritthiruangdej S., Parnbankled S., Donchedee R. and Wongsagonsup, 2011. Physical, chemical, textural and sensory properties of dried wheat noodles supplemented with unripe banana flour. J. Nat. Sci., **45**:500-509.
- Sadasivam S. and Manickam, A., 1997. Biochemical Methods (2nd Ed.). New Age International private limited, New Delhi and Tamil Nadu Agricultural University, Coimbatore, 254p.
- Shahanas E., Remya P.R., Sharon C.L., Aneena E.R. and Panjikkaran S.T., 2017. An instant jackfruit pudding mix: value addition through product diversification [abstract]. In: Abstracts, International work shop on production value addition and marketing of jackfruit; 9-14, August, 2017, Kerala Agricultural University, Regional Agricultural Research Station, Wayanad, p. 32. Abstract No. 17.
- Srinivasan K. and Nirmala R., 2014. A study on consumer behaviour towards instant food products. IOSR J. Business Manag., **16**:17-21.
- Sunday F.O. and Dayo F. E., 2012. Effect of storage on the proximate, mineral composition and microflora of tinco. Global J. Biosci. Biotechnol., **1**:54-58.