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Product Development: Snacks Prepared From Jackfruit Seed Flour and Corn Flour

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ABSTRACT

Jackfruit (*Artocarpurs heterophyllus*) belongs to family *Moraceae*. The fruit is accounted to be endowed with variety of nutrients. It is enclosed with good amount of carbohydrates, proteins and also a good source of vitamin B and C. The seed comprises up to 10-15 % total fruit weight. Jackfruit seed flour assimilate good amount of starch, dietary fibre, iron, thiamine, riboflavin and vitamin A. Study was attempted to develop JSF (Jackfruit Seed Flour) based fried and baked snack food and analysed for its nutrimental, physico-chemical and sensory aspects. On the basis of sensory analysis of baked and fried snacks, sample D (70% jackfruit seed flour and 30% corn flour) comes out to be best in terms of the acceptability.

INTRODUCTION

Jackfruit (*Artocarpurs heterophyllus*) belongs to family *Moraceae*. The fruit is accounted to be endowed with variety of nutrients. It is enclosed with good amount of carbohydrates, proteins and also a good source of vitamin B and C. The seed comprises up to 10-15 % total fruit weight. Jackfruit seed flour assimilate good amount of starch, dietary fibre, iron, thiamine, riboflavin and vitamin A.(Swami *et al* 2012).

The curative properties of the fruit are well stated in Ayurveda (*Gupta et al.,* 2009). The plant is proclaimed to hold phytonutrients as lignans, isoflavones and saponins which broadcast antibacterial, anti-inflammatory, antioxidant and ant diabetic properties. Inclusion of JSF by replacing wheat flour can significantly increase the nutrimental profile of the snack food (*Tafazzal et. al.*, 2014*).*

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Most of the studies provide much impetus towards the utilization of the fruit pulp in the formulation of fruit leather and chips, the fruit part is largely used in the fabrication of baby foods, jam, jelly, candies, and marmalades. However the whole fruit is consumed as a functional and medicinal food. The fruit and its parts have exhibited miraculous potential in the food formulations where the seed part is somehow used in desserts and the flour have been used to produce bakery items. Despite of massive alimentary potential, jumbo fruit and its various parts specially seed is reckoned as a waste product and hence underutilized due to shortfalls in postharvest technology and significant losses owing to inefficient food supply chains.

This study indicates how utilization of crop waste can provide alternative income streams for local farmers and help improve local economies. The researchers conclude that jackfruit seeds are capable of being used as an important ingredient in the formulations of novel and healthy foods. Keeping into consideration the perishability and availability of the jackfruit seeds were ground to flour and were blended with corn flour for the additional nourishment of the product.

The present day scenario exhibited the consumers liking for the snack foods. The insight of this research is aimed to utilize the jackfruit seed which is else wise considered as a waste in the preparation of nutritious snack food. Jackfruit seed flour has risen as an economical substitute of starch and its potential in the genesis of novel product. The present study is attempted giving special attention towards school going children. Asthe children need adequate nutritional intake to meet the growth and body requirements. Hence food consumed by them should be rich nutritionally. Furthermore, the available choices to buy healthy and nutritious food products are very fewer in the market. So, this remarkably calls out for the formulation of value added products in the market. Therefore the study is designed to determine (a) effect of incorporation of jackfruit seed flour on the physico-chemical, nutritional and sensory properties of snack food and (b) effect of packaging on shelf life of snack food in terms of thiobarbituric acid, total phenolic content and free fatty acid during the period of storage.

MATERIALS AND METHODS

Raw Material

The seeds (jackfruit) were collected from local farm of Nilambur, Kerala, India. The seeds were washed manually and white arils (seed coat) were peeled off manually. Seeds were lye peeled soaking

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in 3% sodium hydroxide solution for 3-5 minutes in order to remove thin brown layer by rubbing the seeds manually followed by washing under running water to remove traces of lye. The treated seeds were chopped into thin slices and kept for drying in tray dryer at 60°C to constant moisture. The thin dried seeds were ground flour passed through 60mm mesh sieve and packed in polyethylene pouches and stored in a refrigerator (<10° C) for further analysis.

Snack Preparation

Fried snacks and baked snacks

The snack food was prepared using blends of jackfruit seed flour and corn flour in six different proportions formulations. The dough so formed was rolled into thin sheets approximately 1.5–2 mm thick and cut with a cutter into triangular shapes. The just formed triangular shaped sheets were deep fat fried (150°C -160°C for 3 minutes) and baked in oven (130°C-140 °C for 8-10 minutes).

Proximate Analysis

The moisture content of different samples was determined by drying to gain constant weight in an oven at 105 ±2°C. The ash and fibre content of fried and baked snack food was carried out according to standard procedures of AOAC (1995).Total protein content was calculated as nitrogen X 6.25.The fat content was determined by using Pelican Soxtech (model SCS 4).The weight difference method was used to determine the carbohydrate content. All the samples were analysed in duplicates.

Functional properties of Jackfruit seed flour

The Water absorption and oil absorption capacity were determined as per the method outlined by Ocloo *et al.,*(2010). Swelling power and bulk density were measured according to the method described by Abraham and Jayamuthunagai (2014).

Sensory quality evaluation

The snacks prepared after baking and frying were subjected for sensory evaluation. The score record sheet was prepared based on the nine point hedonic rating scale as described by Amerine, Pangborn and Roessler (1965). The samples were evaluated for colour, texture, taste mouth feel and overall acceptability by a panel of judges .The evaluation was carried out at 25±2°C, and the mean score of all attributes was used to draw the consumer's acceptance for the product.

Statistical analysis

Analysis of variance test was carried out using commercial statistical package SPSS ver 16.0 (SPSS Inc., Chicago, II., USA). All data were calculated as means ± SD. Mean values were compared and significant difference were assessed using Duncan's LSD test ($p \leq 0.05$).

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RESULTS AND DISCUSSION

Physico-chemical and functional properties of Jackfruit seed flour

Physico-chemical properties of jackfruit seed flour has been depicted in **Table 1**, indicating that it is a good source of carbohydrates, protein, fibre and ash (minerals) content and the estimation agree with the result reported by Chowdhury*et al.,* (2012) and Tafazzal*et al.,* (2014) .The results for functional properties as shown in **Table 1** depicted lower values for water absorption capacity (189 %) as compared to the findings of Tulyathan*et al*., (2002) who recorded water absorption capacity as(202%) . This might be due to difference in the variety. However oil absorption capacity was similar to the results reported by Tulyathan*et al*., (2002). Swelling power and bulk density were found to be higher than the results shown by Ocloo *et al*., (2010).The attributes of the flour exhibited its suitability in the preparation of nutritionally rich snack food.

Sensory analysis

Results of Sensory evaluation of fried and baked snacks prepared with different formulation of jackfruits seed flour and corn flour are shown in Table 3 and Table 4 respectively. The score for colour, texture, taste, mouth feel and overall acceptability was found to be more acceptable for the sample D (70:30) as compared with other composition in fried and baked snacks.

Physico-chemical analysis of snack food

Data pertaining to the quality evaluation of snack food i.e. fried and baked is presented in Table 2 indicating that baked snacks tend to have more moisture (7.07 %) as compared to fried snacks (3.26 %).This is may be due to water vaporization during baking and frying. The results were in agreement with those reported by *Elkhalifa et al.,* (2014). Table 2 shows that fried snack food has higher fat content as compared to the baked ones, 23.08% for the fried and 6.86% for the baked chips and this higher fat content in the fried chips is due to the residual remained oil after deep frying , *Elkhalifa et al.,* 2014.The difference in values depicted (Table 2) for the ash , protein and fiber were non-significant.

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Effect of packaging material on thiobarbituric acid and free fatty acids of snack food during storage

The snack food (baked and fried) was analyzed for the oxidation using free fatty acid and TBA estimation. The changes are presented in Table 5. Results indicated that there was a significant increase in the free fatty acid values of the snack food (baked and fried) stored in different packaging material (LDPE and metalized pouches) at the room temperature. It is noticeable that initially the snack food (baked and fried) stored in contained a low amount of FFA which further increased progressively with the storage time. Similar findings were reported by *Padmashree et al*.,(2013).

However the storage stability of the snack food (baked and fried) was analyzed by the means of TBA value. The initial thiobarbituric acid value of the snack food (baked and fried) stored in LDPE pouches was 0.514 and 1.045 mg/MA/kg respectively but after 28 days of storage at room temperature, a progressive increase in the values was observed (as 1.023 and 1.454 mg/MA/kg) respectively. It was evident from the data in table that there was a n increase in the TBA values of the snack food (baked and fried) stored inLDPE and metalized pouches at room temperature. The higher rate of peroxidation in polypropylene samples was due to the higher oxygen permeability as compared to the metalized polyester packaging material.

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Table 1: Physico-chemical and function properties of jackfruit seed flour

Physico- chemical properties	
Constituent	Value
Ash	2.93±.55%
Moisture	10.3±.56%
Carbohydrate	68.87±.23%
Crude fat	1.40±.84%
Crude protein	13.8±.62%
Crude fiber	2.9±.12%

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Titratable acidity	1.25±.11%
pH	6.2±.13
Functional properties	
Constituent	Value
Water absorption capacity	189%
Oil absorption capacity	93%
Swelling power	4.94
Bulk density	1.31g/cm^3

Table 2: Physiochemical analysis of snack food

Constituents	**Baked**	**Fried**
Moisture	7.07±0.68 [b]	3.26±0.35 [a]
Ash	2.50±0.44 [a]	2.94±0.35 [b]
Protein	11.60±0.46 [a]	11.17±0.36 [a]
Fat	6.86±0.75 [a]	23.08±0.53 [b]
Fiber	2.45±0.23 [a]	2.86±0.30 [a]

Table 3 :Sensory analysis of fried snack food

Formulation	Colour	Texture	Taste	Mouth feel	Overall acceptability
A (100:0)	7.83±0.28 [b]	6.83±0.28 [b]	6.66±0.57 [c]	6.25±0.43[d]	6.00±0.13[d]
B (90:10)	7.83±0.28 [b]	7.16±0.28 [b]	6.66±0.57 [c]	6.41±0.38[cd]	7.00±0.15[cd]

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C (80:20	7.91±.14 [b]	8.00[a]	7.66±0.28[ab]	7.08±0.14[b]	7.50±0.1 [b]
D (70:30)	8.50±0.5 [a]	8.08±0.38 [a]	8.25±0.43 [b]	7.91±0.14 [a]	8.25±0.15 [a]
E (60:40)	7.91±0.14 [b]	7.75±0.25 [b]	7.50±0.5[abc]	7.00[bc]	7.50±0.15 [b]
F (50:50)	7.33±0.28 [b]	7.75±0.25 [b]	7.16±0.28[bc]	6.58±0.52[bcd]	7.50±0.12 [c]

Values are mean ± standrard deviation of triplictaes.

Values represented in small letter superscript in row differs significantly($p<0.05$)

Table 4 : Sensory analysis of baked snack food

A (100:0)	Colour	Texture	Taste	Mouthfeel	Overall acceptability
B (90:10)	6.83±0.28 [b]	5.50±0.66 [c]	5.16±0.28 [d]	5.58±0.52 [c]	5.77±0.39 [d]
C (80:20	6.75±0.43 [b]	5.75±0.66 [c]	5.58±0.52[cd]	5.66±0.57 [c]	5.93±0.54 [d]
D (70:30)	7.00[b]	6.83±0.14 [b]	6.00[c]	5.91±0.14 [c]	6.43±0.07 [b]
E (60:40)	8.16±0.28 [a]	7.83±0.28 [a]	7.66±0.57 [a]	7.91±0.44 [a]	7.89±0.32 [a]
F (50:50)	7.33±0.57 [b]	6.83±0.28 [b]	7.16±0.28[ab]	7.00[b]	7.08±0.28 [b]
A (100:0)	7.33±0.57 [b]	6.75±0.25 [a]	6.83±0.28 [b]	6.91±0.14 [b]	6.95±0.31 [c]

Values are mean ± standrard deviation of triplictaes. Values represented in small letter superscript in row differs significantly($p<0.05$)

Table 5: Change in thiobarbituric acid and free fatty acids of snack bar stored at room temperature

	Packaging material	**Type of snack**	**Storage period**				
			0^{th} day	7^{th} day	14^{th} day	21^{st} day	28^{th} day
Thiobarbituric acid (mg/MA/kg)	LDPE	Baked snack	0.514±0.03[d]	0.574±0.03[d]	0.836±0.05[c]	0.920±0.08[b]	1.023±0.10[a]

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		Fried snack	1.045±0.02^{b}	1.169±0.02^{ab}	1.316±0.05^{ab}	1.422±0.02^{a}	1.454±0.05^{a}
	Metalized pouch	Baked snack	0.514±0.03^{d}	0.543±0.11^{d}	0.668±0.03^{c}	0.902±0.08^{b}	0.982±0.02^{a}
		Fried snack	1.045±0.02^{d}	1.120±0.06^{c}	1.181±0.04^{b}	1.219±0.02^{b}	1.307±0.05^{a}
Free fatty acids (%)	LDPE	Baked snack	0.099±0.01^{d}	0.111±0.02^{d}	0.140±0.01^{c}	0.178±0.03^{b}	0.207±0.01^{b}
		Fried snack	0.140±0.01^{d}	0.168±0.01^{c}	0.181±0.02^{c}	0.230±0.01^{b}	0.289±0.02^{a}
	Metalized pouch	Baked snack	0.099±0.01^{c}	0.103±0.01^{c}	0.133±0.01^{b}	0.156±0.01^{a}	0.170±0.01^{a}
		Fried snack	0.140±0.01^{d}	0.156±0.01^{cd}	0.165±0.01^{bc}	0.185±0.01^{b}	0.207±0.01^{a}
Moisture content (%)	LDPE	Baked snack	10.96±0.68^{a}	11.63±0.28^{c}	12.72±0.11^{b}	13.41±0.39^{b}	14.61±0.28^{a}
		Fried snack	3.26±0.35^{c}	3.90±0.21^{b}	4.28±0.30^{b}	4.87±0.31^{a}	5.25±0.35^{a}
	Metalized pouch	Baked snack	10.96±0.68^{a}	11.48±0.22^{bc}	11.92±0.20^{b}	12.83±0.24^{a}	13.13±0.49^{a}
		Fried snack	3.26±0.35^{d}	3.71±0.21^{cd}	4.17±0.28^{bc}	4.56±0.41^{ab}	4.89±0.29^{a}