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Formulation of Jackfruit Bulb (*Artocarpus heterophyllus*) Flour and Wheat Flour Composite for Noodle Production

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Abstract: This study investigated the reduction of postharvest losses of Jackfruits by value addition and formulation of jackfruit bulb flour and wheat flour composite for noodle production in the local market. Jackfruit bulbs were subjected to mechanical drying, grinding and sieving (particle size <200µm) to yield the jackfruit bulb flour. The composite flour consists of different ratios of jackfruit bulb flour (60%, 50%, 40%, and 30%) with wheat flour. The proximate composition, physical properties and sensory characteristics of formulated composite flour were determined. Sensory attributes of the formulations were evaluated using Hedonic scale (9-points) with 30 semi trained panelists. The best flour composites were found to be the jackfruit bulb flour to wheat flour at the ratio of 60:40 and 30:70. In comparison to 100% wheat flour, jackfruit bulb flour-based noodles are rich in carbohydrate and fiber content. Carbohydrate (65.900A±0.642%), protein (20.100A±1.236%), fiber (1.010AB±0.020%) and ash (2.840A±0.347%) contents were higher in the 125 composite flour (jackfruit bulb flour: wheat flour = 60: 40) than the other formulations. As a value-added product, Jackfruit flour based 125 composite flour formulation (jackfruit bulb flour: wheat flour = 60: 40) has a higher potential for commercialization as a convenient, cost-effective and nutritional alternative noodle product for the consumers with busy lifestyles.

Keywords: Jackfruit flour, Formulation, Composites, Value-added, Alternative, Noodles

1 INTRODUCTION

Noodle is a staple food made from unleavened dough which is stretched, extruded, or rolled flat and cut into one of a variety of shapes by using extrusion technology and usually cooked in boiling water, sometimes with cooking oil or salt added. Noodles are widely consumed

throughout the world and their global consumption is second only to bread (Jayasena v., 2008). Sri Lanka, being a tropical country and due to recurring shortages in wheat production, imports 6,314,380Kg of wheat by spending $2,663.70 K annually for milling. The Dollar crisis and tightening trade policies have increased wheat prices in the local Sri Lankan market. Therefore, wheat flour-based product manufactures are turning to alternative sources of carbohydrates derived from rice, root flour and jackfruit. Jackfruit (*Artocarpus heterophyllus*) belonging to genus *Artocarpus* is a well-known perennial tree in Sri Lanka. The tree originated in India and is commonly known as "Kos" (Sinhala) and "Pala" (Tamil) in Sri Lanka (Lakmali, 2021). Jackfruit is one of the popular staples during scarcity of food in Sri Lanka (Hettiaratchi, 2011). Edible parts of Jackfruit trees consist of immature, mature and ripe fruits. Mature fruit is tree-borne fruit, having up to 35 kg weight, 90 cm length, and 50 cm diameter (Nair, 2017). The fruit contains a large number of fleshy bulbs, spikes and seeds which are covered by the fleshy white cotyledon (Ranasinghe, 2019). Jackfruits are abundant during the season and substantial postharvest losses are experienced. At present, there is a higher consumer preference and demand for value added convenient food products. Therefore, the value-added products of Jackfruit would be a good source of income for the small and medium scale industries as well as a nutritional supplement rich in carbohydrate and fiber for the Sri Lankan community. Therefore, this study was designed to evaluate the potential of producing value added food products using Jackfruit and also, to formulate composite flour mixture to obtain preferred organoleptic characters in the final noodle product.

2 METHODOLOGY

2.1 Experimental site

The research was conducted at HJS Condiments LTD. Block 61,62 & 63. Biyagama Export Processing Zone, Biyagama and Department of Biosystems Technology, Uva Wellassa University of Sri Lanka.

2.2 Preparation of Noodle

To prepare flour samples, different ratios of jackfruit bulb flour (JFB) to wheat flour (W) were mixed as treatments, 264 (JFB: W = 30:70), 427 (JFB: W = 40:60), 355 (JFB: W = 50:50), 125 (JFB: W = 60:40) and the controller 545 (JFB: W = 00:100). The dough was covered with wet muslin cloth and kept at 30 ℃ for 5 minutes followed by place into primary rolling. Two rolls were kept together to perform secondary rolling. After the sheeting of dough was passed through an extruder (pasta making machine) to result in noodle shape. The product was steamed at 100 - 120 ^{0}C for 10-20 minutes. The steamed noodles were dehydrated using a dehydrator at 65 ℃ for 3 hours. Finally, the product was cooled to room temperature for packaging.

2.3 Statistical Analysis

Experimental design used is Complete Randomized Design. Sensory evaluation results were analyzed using Friedman Non Parametric Analysis with MINITAB software.

2.4 Sensory Evaluation

In sensory evaluation, Jackfruit based noodles color, texture, flavor, aroma, and overall acceptability were evaluated by a scoring method using a 9-point hedonic scale with a panel of 30

semi trained panelists. According to the results of the sensory evaluation of the Friedman Test, color, texture, flavor, aroma, and overall acceptability of all treatments [treatment numbers; 264, 355, 427, 125, 545] were significant ($p<0.05$) different. Treatment number 125 (Jackfruit flour: Wheat flour = 60:40) and treatment number 264 (Jackfruit flour: Wheat flour = 30:70) received the highest means for all sensory parameters (Table 1). The accepted proportion of 60% of Jackfruit flour noodles (treatment number 125) by panelists was considered to assess the level of consumer acceptability.

2.5 Data Analysis

According to the texture scores of noodles 60% of Jackfruit flour and 40% of Wheat flour recorded a value of 6.60 as that of control for their very good texture profile. That recorded a similar value from treatment number 264 and controller 545. The flavour of 60% Jackfruit flour incorporated noodles recorded the values as 7.90. Further, the controller recorded the lowest value of 5.40. The aroma of treatment number 125 recorded the highest value-based noodles and documented the very good aroma. The statistical test revealed that a significant difference was observed between all the treatments under every sensory parameter. The overall acceptability of noodles showed that the treatment number 125 scored the highest value of 8.00 for its moderately good acceptability. All the below noodles products in Table 1 are presented in different percentage incorporation of Jackfruit flour noodles.

3 RESULTS AND DISCUSSION

Table 1 Results of sensory analysis of all treatments

Sensory attribute	Estimated means received for different samples					P value	Highest sum ranks
	125	**264**	355	427	545		
Color	8.00	5.40	4.40	4.00	6.20	0.000	148.0
Texture	6.60	6.00	5.20	5.20	6.00	0.000	122.5
Flavour	7.90	5.70	6.00	6.00	5.40	0.000	142.5
Aroma	8.00	5.80	6.20	6.00	6.00	0.000	130.5
Overall acceptability	8.00	6.00	5.40	5.70	5.90	0.000	144.0

All the panelists have detected these composite noodles' characteristics on the basis of different properties described above. The diverse combinations of texture and taste have made noodles a universal appeal and gain a unique status. P values for the sensory attribute; color, texture, flavour, aroma, and overall acceptability (0.000) were less than 0.05, hence there was a significant difference between within five treatments.

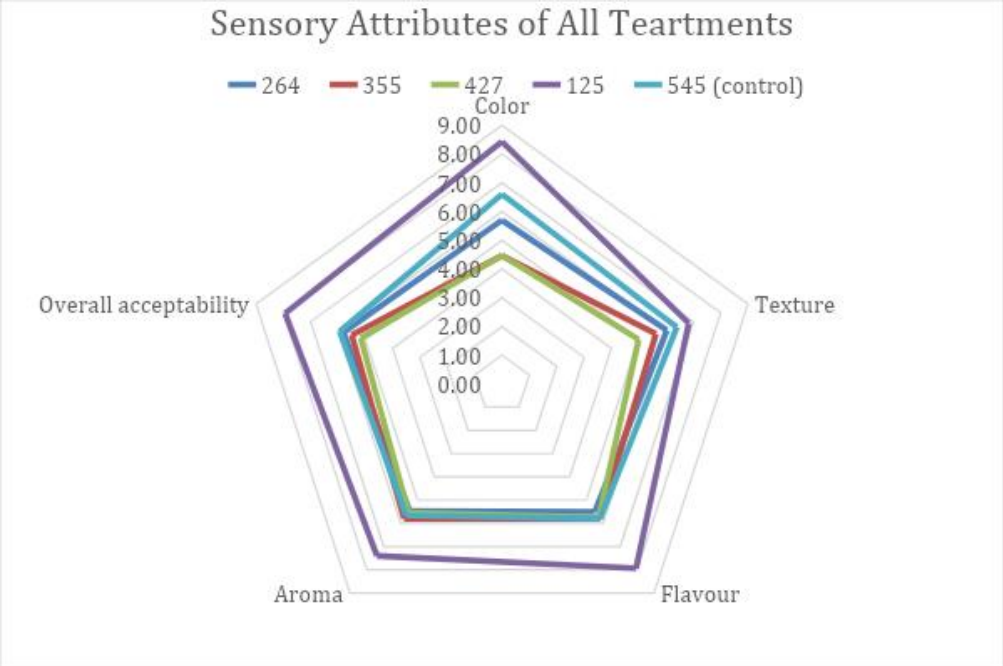

Fig. 1. Sensory Attributes of All Composite Formulations

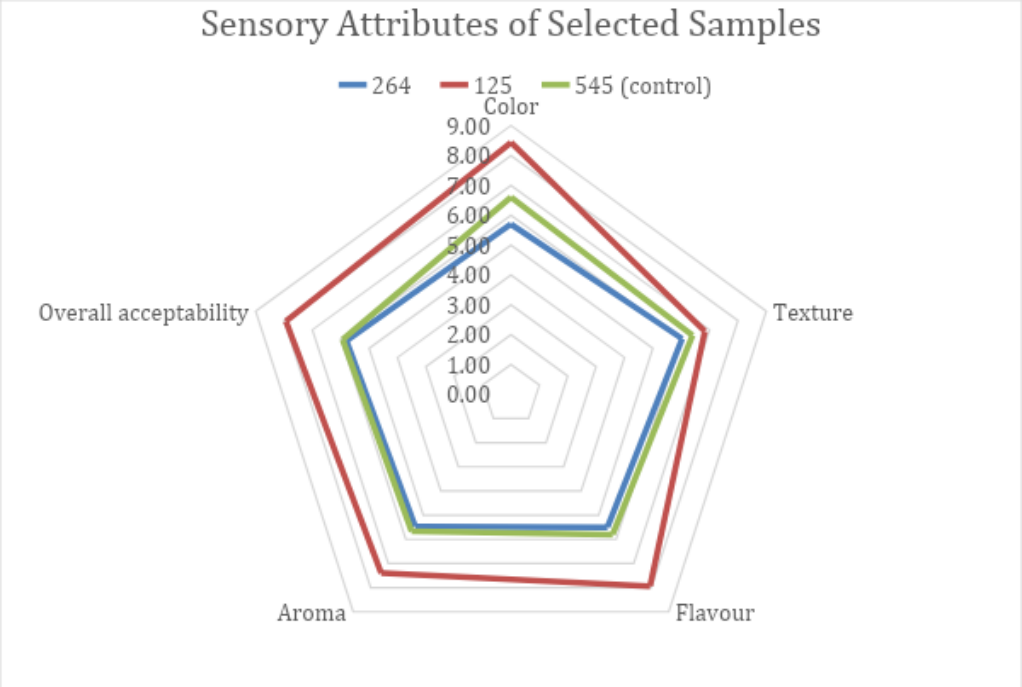

Fig. 2. Sensory Attributes of Selected 125, 264 and 545 Samples

Those selected samples' sensory attributes (Fig.1. and Fig. 2.) have given the results that treatment number 125 is the highest estimated means for color, texture, aroma, flavour, and overall acceptability. Hence, 125 sample was selected as the best ratio of Jackfruit bulb flour and Wheat flour (60:40) mixture. The summary of the result is that the highest combination of Jackfruit bulb flour noodles was given the highest rank over Wheat flour noodles. Jackfruit seed flour is cheaper than Wheat flour because this product can sell at a cheaper price than normal Wheat flour noodles under this current situation in Sri Lanka.

Proximate Analysis

Moisture content, ash content, crude fat content, fiber content, protein content, and carbohydrate content were determined under the proximate analysis for selected Jackfruit flour-based noodles (treatment number 125 and treatment number 264) as a comparison with the controller. Three replications were used and the average values for the above parameters.

Table 2 Analysis of moisture content, ash content, crude fat, fiber content, protein content, and carbohydrate content in 125, 264 and 545 (control) samples

Parameters	Samples Types			P value
	125	264	545 (Control)	
Moisture Content %	$5.002^{B}\pm0.055$	$5.601^{A}\pm0.281$	$5.740^{A}\pm0.208$	0.010
Ash Content %	$2.840^{A}\pm0.347$	$2.400^{A}\pm0.265$	$2.650^{A}\pm0.270$	0.185
Crude fat %	$5.100^{A}\pm0.506$	$5.800^{B}\pm0.356$	$8.460^{A}\pm0.450$	0.000
Fibre content %	$1.010^{AB}\pm0.020$	$1.200^{A}\pm0.645$	$0.440^{B}\pm0.065$	0.104
Protein content %	$20.100^{A}\pm1.236$	$19.720^{A}\pm0.917$	$18.600^{A}\pm0.463$	0.201
Carbohydrate Content %	$65.900^{A}\pm0.642$	$65.280^{AB}\pm1.038$	$64.110^{B}\pm0.138$	0.054

Values with different superscript letters in columns are statistically significant ($P<0.05$). The significance of the difference was determined by a one-way Analysis of Variance using Fisher Pairwise Comparisons in Minitab 17. $^{A-B}$ Means with different superscripts in the same column show significant difference. The analysis of moisture content weekly based on comparing those samples treatment 125 has a low increasing rate with comparing the controller and treatment number 264. The treatment number 264 has the highest increasing rate. According to those results Jackfruit flour noodles (treatment number 125) have the lowest moisture absorption rate and better expiration date than treatment 264 and controller. When comparing the results, treatment number 125 has the lowest water activity. Under the weekly record shows the low increasing rate for the water activity in treatment number 125. The highest rate is shown in treatment 264.

4 CONCLUSIONS

The results of the study development of composite flour formulation using jackfruit bulb flour and wheat flour was successful and the composite flour formulation treatment number 125, and treatment number 264, consisting jackfruit bulb flour to wheat flour ratios of, 60:40 and 30:70 respectively were selected as the best composite flour formulations for noodle production. The best formulation was further tested and confirmed using proximate composition analysis, physical properties and consumer acceptability test. Flour composite 125 contains comparatively higher nutrient content and consumer acceptability than other formulations. Hence, Jackfruit bulb flour based 125 composite flour formulation (jackfruit bulb flour: wheat flour = 60: 40) has a higher commercial potential for mass-scale production as a convenient and cost-effective food for the consumers with busy lifestyles in the Sri Lankan community.

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