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Organoleptic, Nutritional and Phytochemical Traits of *Artocarpus heterophyllus* Seed Flour Incorporated Rusk

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Abstract

The sustainable food system that provides food and nutrition security is the need of the hour. The seeds are typically thrown away as waste due to their perishable nature, but they can last for approximately a month if they are kept in a cold, moist environment. The seeds, if processed, may be added to various foods so as to increase their nutritional value. Jackfruit seed (*Artocarpus heterophyllus*) has great potential as an edible food product. Moderate consumption of jackfruit seeds in any form is useful for minimizing the risk of cardiovascular disease, and lowers the toxic effect in the colon due to its high fibre and antioxidant activity. Being a good source of protein, it helps in muscle building. **Aim:** The purpose of this study is to determine the effect of incorporating jackfruit seed flour on the sensory and nutritional acceptability of the rusk. **Methods and Materials:** The value-added rusk was formulated by incorporation of jackfruit seed flour in different proportions V1(60g wheat flour+ 40g of jackfruit seed flour) and V2(70g wheat flour+ 30g jackfruit seed flour), and V3(80g wheat flour+ 20g jackfruit seed flour). The prepared rusks were subjected to sensory evaluation by untrained panelists using nine-point hedonic scale for consumer acceptability. The accepted variation (V2) was subjected to nutritional analysis and phytochemical analysis as per standard procedures. **Results:** The developed product was found to contain energy (281 Kcals), carbohydrates (63.8 gms), protein (4.6 gms), fat (0.85 gms), and fiber (2.7 gms). The presence of phytochemicals like phytic acid, oxalate, alkaloids, tannins, flavonoids, polyphenols, and saponins was also detected. This study was done to develop value-added rusk to improve the consumption of macro and micronutrients, and phytochemicals among bakery food consumers.

Keywords: Bakery Foods, Jackfruit Seeds, Rusk, Value-addition

1. Introduction

Jackfruit (*Artocarpus heterophyllus)* is a climacteric fruit,the biggest edible fruit from *Moraceae* family, and it is commonly grown in Bangladesh, Burma, India, Indonesia, Malaysia, and Thailand[1]. The various parts of the jack tree, namely fruits, leaves, and barks, have been widely used in traditional medicine due to their anticarcinogenic, antimicrobial, antifungal, anti-inflammatory, wound healing, and hypoglycaemic effects[2]. The ripe jackfruit alone comprises pulp(29%), seeds (12%), and rind (54%), and it is understood that only 29% of the jackfruit is edible[2]. It is a customary practice in India to consume boiled or roasted jackfruit seeds[3].

Jackfruit seeds are a source of carbohydrates, primarily polysaccharides, aneconomical source of protein, lipids, flavonoids, and sulphur[4]. The seeds are also a source of dietary fibre and resistant starch, which aid in controlling blood sugar levels.The magnesium present in jackfruit seed helps lower blood pressure in hypertensive patients and also favours calcium absorption, thus supporting bone health[5]. Jacalin, a lectin found in the jackfruit seeds, aids in assessing the immunity, and is also used as a remedy for alcoholtoxins in heavy drinkers[6].

The gloomy part is that Jackfruit seeds, which are found to treasure of nutrients, is thrown away as waste. The concept of value addition to foods gives a solution to this miserable act. Literature states that, due to increase

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in awareness in the fields of food processing, concepts of wealth or health from waste, several valueadded bakery products like bread[1,6,7], biscuits[6,8], cakes[9,10,11] and muffins[12], value added extruded products namely expanded snacks[13], pasta[14], noodles[15,16], and snack bars[17] had been formulated by incorporating jackfruit seed flour in different proportions. The replacement of starch flour with jackfruit seed flour in food preparations is commendable in terms of its nutritional properties[18].

As rusk is a common bakery snack preferred by people of all age groups and with any kind of chronic ailments, and as it perfectly blends with coffee and tea, this study was initiated to formulate value-added rusk by incorporating jackfruit seed flour.

Objectives of the study are to preparejackfruit seed flour and formulate variations of jackfruit seed flour incorporated value-added rusk, to evaluate the acceptability of the formulated products by organoleptic evaluation, and to analyze the nutritional value and phytochemical properties of the organoleptically accepted variations of rusk.

2. Methods and Materials

2.1 Preparation of Jackfruit Seed Flour

The first objective of the study, to develop jackfruit seed flour and formulate variations of jackfruit seed flour incorporated value-added rusk, is discussed under this section.

The procedure of Tulyathan*et al.* (2002) was adopted with slight modifications to prepare jackfruit seed flour. Fresh jackfruit was purchased from the local market in Salem district, Tamil Nadu, India,and the fruits were separated. The seed and the pulp were fractioned appropriately. The seeds were washed, and the seed coat was peeled off. The seeds were sliced off and dry roasted at 70°C for 30 minutes. After complete removal of moisture, the seeds were milled into flour[19].

2.2 Formulation of Different Variations of Jackfruit Seed Flour Incorporated Rusk

For the formulation of diverse variations of the jackfruit seed flour incorporated rusk, the different proportions of the jack fruit seed flour (0g,40g, 30g, 20g) were incorporated into refined flour (100g, 60g, 70g, 80g) as shown in Table 1. All the ingredients were mixed. Warm water (10ml)and sugar to yeast were added for fermentation.The mixed ingredients were kneaded for 3-5 minutes, along with fermented yeast, into soft dough and allowed to rest for 10 minutes. The dough was placed in thebaking tray and baked for 25 minutes at 180 °C. It was cut into a rusk shape by using a knife, and then baked again at 180°C for 15 minutes. The different variations of rusk werepreparedand evaluated for organoleptic acceptability using a 9-point hedonic rating scale. The accepted variation of the rusk was further subjected to proximate and phytochemical analysis.

3. Results and Discussion

3.1 Organoleptic Assessment of the Jackfruit Seed Flour Incorporated Rusk

The second objective of the study is to evaluate the acceptability of the developed products by organoleptic evaluation. Nine-point hedonic rating scales were used to assess the acceptance of the developed rusks for parameters like appearance, color, texture, taste, flavor, and overall acceptability. Totally thirty untrained respondents were used for sensory analysis.

As evident from Table 2, the organoleptic scores of developed jackfruit seed flour incorporated rusk on different characteristics such as appearance, colour, taste, texture, flavor, and overall acceptability reveal that variation 2 (30% incorporation of jackfruit seed flour) was exemplary in all aspects. It is evident from Duncansmultiple range statistical analysis that the

Table 1. Ingredients for the preparation of jackfruit seed flour rusk

Ingredients	Con trol	Level of incorporation		
		Variation 1 (V1)	Variation 2 (V2)	Variation 3 (V3)
Jackfruit seed flour(g)	-	40	30	20
Refined Flour(g)	100	60	70	80
Yeast(g)	5	5	5	5
Sugar(g)	5	5	5	5
Milk(ml)	5	5	5	5
Vegetable oil(ml)	5	5	5	5
Salt(g)	2.5	2.5	2.5	2.5

variations of *Artocarpus heterophyllus* seed flour incorporated rusk were significantly different in terms of overall acceptability. Research studies disclose that 25% of jackfruit seed flour incorporated breads, 10%-40% of jackfruit seed flour incorporated biscuits and 10%-30% of jackfruit seed flour incorporated cakes were accepted by consumers,[6,8,11]and similarly in this study also 30% of jackfruit seed flour incorporated rusk was highly acceptable.

3.2 Nutritional Analysis of the Accepted Variation of *Artocarpus heterophyllus* Seed Flour Incorporated Rusk

The third objective of the study, to analyze the nutritional value and phytochemical properties of the organoleptically accepted variations of rusk is detailed below.

Table 3 depicts that rusk prepared with jackfruit seed flour is lower in energy content than the control. The energy content present in the accepted variation was 281 kcal/100g which is lower than the control (433 kcal/100g) with the difference of -152kcal. The carbohydrate content present in the accepted variation was 63.8g which is lower than the control (80.7g/100g) with the difference of -16.9g. The protein content present in the accepted variation was 4.6g/100g which is greater than the control (1.8g/100g) with the difference of +2.8g. Studies state that the protein content of jackfruit seed flour ranges between 13g and 18g[20]. The fat content present in the accepted variation was 0.85/100g which is lower than the control (1.15g/100g) with the difference of -0.30g. The fibre content present in the accepted variation was 2.7g/100g. It was found that cereal snack bars developed from 30% jackfruit seed flourand 40% jackfruit seed flour showed presence of more fiber content[21]. A study which utilized the mixture of wheat flour and jackfruit seed flour for waffle ice cream cone preparation contained 11.27 and 6.82% moisture, 11.27 and 15.69% protein, 1.33 and 0.66% fat, 0.71 and 2.85% ash and 1.85 and 3.04% crude fiber[22]. A progressive increase in the proximate parameters like protein, ash and fibre and lower levels of fat was observed in jackfruit seed flour incorporated bun samples[23].

3.3 Phytochemical Analysis of the Accepted Variations of Rusk

From Table 4, it can be inferred that the accepted variation of *Artocarpusheterophullus* seed incorporated rusk contains phytic acid, oxalate, alkaloids, tannins, flavonoids, polyphenols, and saponins. Many research studies have proved that jackfruit seed flour can be utilized as a productive functional ingredient with advantageous nutraceutical properties owing to its

Table 3. Nutrient composition of control and accepted variation of rusk

Nutrients	Control (100 gms)	Accepted variation (V2) (100 gms)	Difference
Energy (Kcal)	433	281	-152
Carbohydrates (g)	80.7	63.8	-16.9
Protein (g)	1.8	4.6	+2.8
Fat (g)	1.15	0.85	-0.3
Fibre (g)	0	2.7	+2.7

Table 4. Phytochemical analysis of the accepted variations of rusk

Phytochemicals	Present/absent
Phytic acid	++
Oxalate	++
Alkaloid	++
Tannins	++
Flavonoids	++
Polyphenols	++
Saponins	++

Table 2. Duncan's multiple range test for organoleptic analysis of the rusks

Variations	Appearance	Color	Texture	Taste	Flavour	Overall acceptability
Control	7.50±0.62 ^{a}	8.03±0.55 ^{ab}	7.80±0.71 ^{a}	7.80±071 ^{a}	7.56±0.62 ^{a}	7.63±0.55 ^{a}
Variation 1	8.20±0.84 ^{b}	8.20±0.55 ^{b}	8.23±0.67 ^{b}	8.26±0.63 ^{b}	8.26±0.58 ^{a}	8.33±0.47 ^{a}
Variation 2	8.66±0.47 ^{c}	8.53±0.50 ^{c}	8.63±0.49 ^{c}	8.60±0.49 ^{b}	8.56±0.50 ^{c}	8.73±0.44 ^{c}
Variation 3	8.20±0.80 ^{b}	7.86±0.68 ^{a}	8.20±0.66 ^{b}	8.26±0.69 ^{b}	8.20±0.48 ^{b}	8.26±0.44 ^{b}

Values are presented as mean±S.D. Variations with different superscripts in a column are significantly different.

elevated phytonutrient content[24]. Phytochemical analysis of jackfruit seeds showed a high amount of saponins (6.32 g/100 g)[25]. The free radical scavenging, metal chelating, and FRAP assays prove that the seeds of jackfruit display potent antioxidant parameters and a judicious concentration of phytonutrients such as total phenols and flavonoids (0.86 to 4.05), and thus, jackfruit seed flour can be sourced as a potent nutraceutical[26].

4. Conclusion

This millennium urges us toensureand meet sustainable development goals to face the challenges of nutrition and food security. Effective utilization of food wastecan be a suitablealternative to trim down postharvest losses and fabricate value-added food products. Jackfruit seed, being one of the most underutilized, with enormous therapeutic and nutritional importance, should not be discarded as waste, and in this study, it is proventhat jackfruit seed can be very well utilized in food formulations. It can be summarized that 30% incorporation of jackfruit seed flour improves sensory parameters and nutritional properties. As a result, the jackfruit seed flour will find immense application in the food, nutraceutical, and pharma industries. Furthermore, clinical trialsarevital to study the impact of jackfruit seed flour incorporated foods on human health.

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