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Effect of Addition of Jackfruit Seed Flour on Nutrimental, Phytochemical and Sensory Properties of Snack Bar

SAYOOJ MAMMALY MEETHAL, NARINDER KAUR, JYOTI SINGH and YOGESH GAT*

Department of Food Technology and Nutrition, Lovely Professional University, Phagwara-144 411, India.

Abstract

Present study is undertaken with the aim of estimating quantitative changes in nutritional, phytochemical and sensory properties of snack bar. Nowadays consumers are more concerned about their health, so the need for the nutraceuticals has been increased. In view snack ball was prepared using varied concentrations of jackfruit seed flour and ragi in three different formulations. Present study also quantifies changes in thiobarbituric acid, free fatty acid, total phenolic content and antioxidant activity of snack bar packed in polypropylene and metalized polyester films and stored under room temperature conditions for 28 days of storage study. During storage at room temperature thiobarbituric acid and free fatty acid content were increased while total phenolic content and antioxidant activity were decreased with increase in temperature and progression of storage period. Maximum retention of phytochemicals was observed in the snack ball packed in polypropylene as compared to metalized polyester films and stored at room temperature conditions. Present study indicates potential application of jackfruit seed flour for preparation of low cost nutritious value added product.

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Keywords

Underutilized plant source, nutritional analysis, phytochemical properties, storage study

Introduction

In recent years food industries are facing challenge of developing new products for healthy and quality of life. To obtain healthy diet, there is a need to find new plant sources with higher nutritive profile. Consumers are also now giving more importance to healthy and nutritious quality food. There are many value added products in the market which are made from different sources such as milk, cereals, meat etc. Nowadays nutritional bar have become popular among people. It is very easy to manufacture and can be sold at low price depending upon the ingredients[1]. Snack bars can be considered as convenient means of supplying nutrients in human diets[2]. Gat and Ananthanarayan[3] has successfully utilized jackfruit seed flour for preparation of value added snacks.

Present study is undertaken keeping a focused view on school going children. As school going

CONTACT Yogesh Gat yogeshcft10@gmail.com Food Technology and Nutrition Department,Lovely Professional University, Phagwara-144 411, India

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children require nutritious foods for their enhanced body requirements. Hence food consumed by them should be rich in vitamins, minerals, carbohydrates, proteins and fats. The options available for the children to buy whole food and nourishing food products are very less in number. This gap needs to be filled by developing value added product that is emerging trends of nutraceutical and functional foods. Therefore present study aimed to determine (a) effect of addition of jackfruit seed flour on nutrimental, phytochemical and sensory properties of snack bars and (b) evaluate effect of packaging on shelf life of snack bars in terms of free fatty acid, thiobarbituric acid, antioxidant activity and total phenolic content during progression of storage.

Materials and methods

Preparation of raw material

Dried jackfruit seeds were collected from local market of Jalandhar, Punjab, India and ground with the help of hammer mill to pass through 80 mesh sieve. Jackfruit seed flour was packaged in sealed polythene bag and kept in refrigerator (~5 ^{0}C) until further use. Other ingredients like ragi flour, jaggery, muesli, ghee and chocolate were procured from the local market Jalandhar, Punjab.

Preparation of snack bar

Snack bar was prepared as per the method given by Ribanar and Hemalatha[4]. Jackfruit seed flour (35-45 g) and ragi flour (5-15 g) constituted the main ingredient and other ingredients like jaggery (25 g), butter (15 g), muesli (10 g) were added either as binding agent, taste enhancer, sweeteners. The bars were packed in polypropylene and metalized polyester and maintained at 20 ^{0}C until further analysis.

Nutrimental analysis

Nutrition analysis such as moisture content (method 923.03), ash content, crude lipid (method 960.52) and fiber content (method 962.09) of raw formulations and snack bar was carried out according to AOAC international methods[5]. Carbohydrate content was determined with the help of weight difference difference method. For nutritional analysis all the samples were estimated in triplicates.

Shelf-life study

Standardized best snack bar samples were packed in polypropylene and metalized polyester films and stored at room and refrigerated temperature conditions for 28 days. Stored samples were analyzed for total phenolic content (mg GAE/g), antioxidant activity (%), thiobarbituric acid (mg MA/Kg) and free fatty acid content (%) after an equal interval of 7 days as per the methods suggested by Padmashree *et al.*[2]. All determinations of shelf-life analysis were done in triplicates.

Sensory analysis

All snack bar samples were prepared for sensory analysis. Samples were evaluated as method suggested by Gat and Ananthanarayan[3] with the use of nine-point hedonic scale.

Statistical analysis

ANOVA test was carried out using SPSS ver.11.5. Values were calculated as mean ± standard deviation and significant differences ($pd \leq 0.05$) were assessed using Duncan's LSD test.

Results And Discussion

Nutrimental properties

Table 1 indicates the nutrimental properties of raw formulations and end product. Proximate analysis showed that jackfruit seed flour used in this study contains 10.13% moisture, 2.75% ash, 1.35% fat, 13.96% protein, 3.59% fibre and 68.40 total carbohydrates (calculated by difference). Moisture content of raw formulations was higher which was decreased to about 4.51-6.14% for the different formulated snack bars. Reduction in moisture content is due to the method of preparation. Hence due to low moisture content of end product, it can be concluded that prepared snack ball has good shelf life. Raw formulations showed lowest fat content which was increased (1.35-13.62%) due to addition of butter for the preparation of snack ball. Fat is a good source of energy and protects internal organs from external shock. Protein content of prepared snack bar ranges from 7.56-9.66%. An increase in protein content in snack bar is attributed to the inherent higher protein content of jackfruit seed flour. It was observed that with increase in concentration

of jackfruit seed flour nutrimental attributes of snack bar formulation were also increased. Similar results of increase in nutritional properties of extruded snacks were observed by Gat and Ananthanarayan *et al* [3] with addition of jackfruit seed flour in cereal based snacks.

Table 1: Nutrimental composition of raw materials and different snack bar formulations

Moisture content(%)	Ash content(%)	Crude fat(%)	Crude protein(%)	Crude fiber(%)	Carbohydrate content (%)
Jackfruit seed flour	10.13±0.57^{b}	2.75±0.21^{d}	1.35±0.03^{b}	13.96±0.06^{d}	3.59±0.17^{d}
68.40±0.14^{b}					
Ragi flour	11.43±0.03^{a}	2.14±0.01^{e}	1.35±0.02^{b}	7.52±0.02^{e}	3.77±0.01^{d}
73.80±0.05^{a}					
Formulation A	4.51±0.16^{e}	0.98±0.07^{c}	13.45±0.50^{a}	7.56±0.06^{c}	2.52±0.12^{c}
68.98±0.01^{c}					
Formulation B	5.48±0.15^{d}	1.14±0.16^{b}	13.56±0.80^{a}	8.41±0.10^{b}	2.95±0.10^{b}
65.46±0.02^{d}					
Formulation C	6.14±0.15^{c}	1.25±0.10^{a}	13.62±0.50^{a}	9.66±0.04^{a}	3.32±0.22^{a}
64.01±0.01^{e}					

Mean values with different superscripts on the same column differ significantly (Duncan's test, p<0.05). Where, Formulation A, B and C contains (35:15; 40:10; 45:5 %) jackfruit seed flour: ragi flour.

Table 2: Change in thiobarbituric acid and free fatty acids of snack bar stored at room temperature

	Packaging materials	Formu-lations	Storage period				
		`	0th day	7th day	14th day	21st day	28th day
Thiobarbituric acid (mgMA/Kg)	Polypropylene	A	0.11±0.004^{a}	0.14±0.004^{a}	0.22±0.011^{a}	0.25±0.012^{a}	0.33±0.004^{a}
		B	0.12±0.004^{a}	0.12±0.013^{b}	0.23±0.016^{a}	0.25±0.004^{a}	0.34±0.012^{a}
		C	0.12±0.011^{a}	0.15±0.004^{a}	0.24±0.011^{a}	0.26±0.008^{a}	0.35±0.004^{a}
	Metalized polyester	A	0.11±0.004^{a}	0.13±0.012^{a}	0.17±0.008^{b}	0.22±0.012^{b}	0.27±0.007^{a}
		B	0.12±0.004^{a}	0.13±0.011^{a}	0.20±0.011^{a}	0.25±0.004^{a}	0.27±0.015^{a}
		C	0.12±0.011^{a}	0.12±0.015^{a}	0.19±0.011^{ab}	0.25±0.008^{a}	0.28±0.011^{a}
Free fatty acids (%)	Polypropylene	A	0.83±0.005^{a}	1.17±0.001^{b}	1.38±0.02^{c}	1.55±0.01^{a}	1.84±0.01^{c}
		B	0.94±0.001^{a}	1.12±0.011^{c}	1.44±0.011^{b}	1.55±0.01^{b}	1.96±0.01^{a}
		C	0.89±0.001^{a}	1.23±0.015^{a}	1.51±0.01^{a}	1.51±0.015^{b}	1.88±0.01^{b}
	Metalized polyester	A	0.83±0.005^{a}	1.00±0.001^{b}	1.18±0.01^{a}	1.33±0.015^{c}	1.56±0.01^{c}
		B	0.94±0.001^{a}	0.94±0.001^{c}	1.17±0.005^{a}	1.39±0.01^{b}	1.61±0.01^{b}
		C	0.89±0.001^{a}	1.06±0.01^{a}	1.06±0.01^{b}	1.44±0.01^{a}	1.72±0.01^{a}

Mean values with different superscripts on the same column differ significantly (Duncan's test, p<0.05). Where, Formulation A, B and C contains (35:15; 40:10; 45:5 %) jackfruit seed flour: ragi flour.

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

Changes in lipid peroxidation during storage of snack bar were monitored by estimating free fatty acids and thiobarbituric acid reported in Tables 2. Free fatty acid is an indicator of oxidative degradation of lipids present in sample. During storage of snack bar at room temperature, there was a significant increase in free fatty acid content value in different packaging materials. It is evident that initially snack bar contained lower amount of oleic acid and which was increased in polypropylene and metalized polyester packaging material with progression of storage under room temperature conditions. Similar finding of increase in free fatty acid content during storage was reported by Padmashree *et al.*[2].

Thiobarbituric acid is a measure of secondary oxidation products such as carbonyls. Initial thiobarbituric acid value in control (0 day) snack bar was in range of 0.11-0.12 mgMA/Kg, but after 28 days of storage at room temperature it was observed that there was an increase in thiobarbituric acid values (0.33-0.35 mgMA/Kg) in polypropylene and (0.27-0.28 mgMA/Kg) in metalized polyester packaging material. It was evident from the data that the rate of peroxidation was highest at room temperature as compared to samples stored at refrigerated condition. Packaging material also played a significant role on the changes of chemical parameters like free fatty acid and thiobarbituric acid content. The higher rate of peroxidation in polypropylene samples was due to the higher oxygen permeability as compared to the metalized polyester packaging material[2].

Effect of packaging material on total phenolic content and antioxidant activity of snack bar during storage

Effect of storage period on total phenolic content and antioxidant activity of formulated snack bar is described in Table 3. Antioxidant activity and total phenolic content decreased during storage at room temperature. Packaging material also played a significant role in decrease in phytochemicals. During storage these decrease in phytochemicals (total phenolic content and antioxidant activity) was due to the oxidation of antioxidant components under favorable conditions. Also decrease in phenolics and antioxidants can be due to dilution of antioxidant components by increased moisture content[6].

Table 3: Change in phytochemical properties of snack bar stored at room temperature

	Packaging materials	Formu-lations	Storage period				
			0th day	7th day	14th day	21st day	28th day
Total phenolic content (mg GAE/g)	Polypropylene	A	44.06±0.92^{a}	36.21±0.37^{b}	31.83±0.50^{b}	26.88±0.14^{c}	22.35±0.14^{c}
		B	44.94±0.21^{a}	37.44±0.40^{a}	33.01±0.08^{a}	29.85±0.28^{a}	25.89±0.24a
		C	44.00±0.28^{a}	34.42±0.29^{c}	29.38±0.08^{c}	27.77±0.08^{b}	23.67±0.21^{b}
	Metalized Polyester	A	44.06±0.92^{a}	37.44±0.21^{c}	33.71±0.16^{c}	29.29±0.38^{c}	24.80±0.21^{c}
		B	44.94±0.21^{a}	39.90±0.24^{a}	37.73±0.08^{a}	32.07±0.35^{a}	26.41±0.32^{a}
		C	44.00±0.28^{a}	39.00±0.35^{b}	35.70±0.21^{b}	30.32±0.58^{b}	25.32±0.14^{b}
Antioxidant activity (%)	Polypropylene	A	59.34±0.26^{a}	45.57±0.26^{a}	39.95±0.20^{b}	36.20±0.35^{b}	25.53±0.26^{b}
		B	54.47±0.17^{a}	44.16±0.09^{b}	42.05±0.26^{a}	37.07±0.17^{a}	26.59±0.20^{a}
		C	52.19±0.17^{a}	42.99±0.26^{c}	37.43±0.35^{c}	35.20±0.10^{c}	24.65±0.26^{c}
	Metalized Polyester	A	59.34±0.26^{a}	49.96±0.26^{a}	44.34±0.10^{a}	34.32±0.09^{b}	26.88±0.46^{c}
		B	54.47±0.17^{a}	47.27±0.17^{b}	41.23±0.27^{b}	33.09±0.26^{c}	30.98±0.26^{a}
		C	52.19±0.17^{a}	46.39±0.30^{c}	40.30±0.26^{c}	35.84±0.17^{a}	28.46±0.35^{b}

Mean values with different superscripts on the same column differ significantly (Duncan's test, $p<0.05$). Where, Formulation A, B and C contains (35:15; 40:10; 45:5 %) jackfruit seed flour: ragi flour.

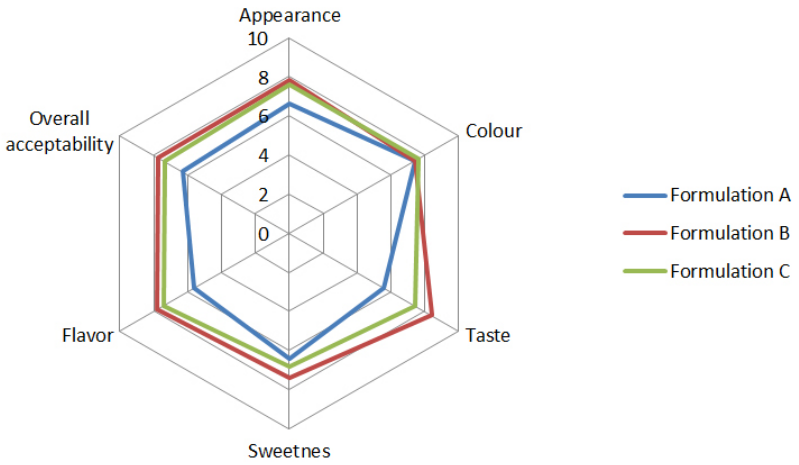

Fig. 1: Radar chart indicating sensory properties of snack bar prepared with different formulations (Formulation A, Formulation B and Formulation C). Where, Formulation A, B and C contains (35:15; 40:10; 45:5 %) jackfruit seed flour: ragi flour.

Sensory properties

Sensory evaluation is the scientific method used to determine the reactions of the consumers to the characteristics of foods. Sensory evaluation of snack bar was performed with the help of sensory panelist. Snack bar was acceptable as the product received rating greater than 6 with respect to the overall acceptance (Figure 1).

Colour is the primary characteristic that plays an important role in the acceptance and rejection by consumers. Based on the results, panelists gave rating above 7 for the three formulations, which indicates the dark brown colour is preferred by the consumers. Dark colour of the outer layer is due to the colour of the chocolate and inner layer is bright brown, due to the caramelization of jagery occurred during heating. The snack bar scored above 6 for both appearance and sweetness. Score of sweetness was increased with the decrease in ragi flour. All of these sensory properties make the product easy to bite and swallow. From this it is conclude that product can be easily liked by the children and elderly people with higher overall acceptance scores for all the three formulations.

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