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STUDY ON THE EFFECTS OF JACKFRUIT PULP ON THE QUALITY OF CAKE

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ABSTRACT

This study reports on preparation of cakes incorporating jack-fruit pulp. The seed free jackfruit bulbs were blended and squeezed through cheesecloth to obtain the pulp. The main ingredients of cakes were wheat flour, jackfruit pulp, sugar, milk power, shortening, water and baking chemicals. The jackfruit pulps used in the cake preparation were analyzed for proximate composition. The cakes were prepared with 0, 5, 10, 15 and 20% jackfruit pulp on flour weight basis. The physical and chemical properties of cakes were analysed. Symmetry, crust and crumb quality, crust colour and consistency, colour and texture of the crumb of the cakes containing 10% pulp were better than those of cakes containing above 10% jackfruit pulp. The statistical analysis of organoleptic test response of sensory attributes revealed that colour, flavour, texture and overall acceptability was decreased with the increase of jackfruit pulp in the cake formulation.

Key words: *Jackfruit pulp, cake, formulation, quality*

INTRODUCTION

Jackfruit (*Artocarpus, heterophyllus*) is the national fruit of Bangladesh. In is considered to be the largest fruit in the world. The jackfruit ranks-third in area and second in production among the fruits in Bangladesh. In Bangladesh, it occupies 66110 acres of land having annual production of 2674 M.tons (BBS, 2000). It contains significant amount of various valuable nutrients and hence it could play an important role for the improvement of malnutrition problem in Bangladesh. According to Anonymous (1997), the ripe jackfruit contains 18.9g carbohydrate, 1.9g protein, 0.1g fat, 1.1g fibre, 0.8g total mineral matter, 20mg calcium, 30mg phosphorous, 500mg iron, 540mg/100g vitamin-A and 30mg thiamine/100g of edible portion of jackfruit. However, it is a seasonal crop and is abundantly available during the harvesting season. Jackfruit base nutrients could be made available throughout the year by preservation of jackfruit in the form of juice, pulp or incorporation this fruits to other prepared food as an ingredient. Now a days cake is the high demanding cereal based food in fast food shop and most of the children are fond of these cakes for its, taste. But cereal based food is lacking vitamins and minerals. Hence, the incorporation of vitamin and mineral riched jackfruit pulp to cereal based cakes will supplement these nutrients in cakes. With this aim in mind this study was undertaken to achieve the following specific objectives:

i) To study the baking quality of cake incorporated with jackfruit pulp.
ii) To find out a suitable formulation for jackfruit pulp based cake
iii) To evaluate the sensory qualities of cake containing jackfruit pulp.

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MATERIALS AND METHODS

The experiment was conducted in the laboratory of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh during 2004-2005. Commercially available wheat flour (Maida) and fully matured, sound, ripe, medium size, soft variety jackfruits were procured from local market of Mymensingh. The pulp extracted from single variety of jackfruit was used in this experiment. Egg, sugar, powder milk, baking powder and shortening (Dalda) were used as raw materials.

Extraction of jackfruit pulp

The jackfruits were cleaned by the water spray and were cut into two halves (length wise) then separated the true bulb from fibrous mesocarp. The seeds coats were also removed from the bulb. The seed free bulbs were blended properly by mechanical blender and the pulp was filtered through cheesecloth. The pulp was also stored at freezing temperature (-6^{O}F) for further use.

Chemical analysis of pulp

The extracted pulp were analyzed for its moisture content, total soluble solid (TSS), ash content, crude fat, protein, reducing sugar and non-reducing sugar by the standard procedure as recommended by Ranganna (1994).

Formulation of cake incorporation with jackfruit pulp

The basic formulation of cakes and cakes with jackfruit pulp is outlined in Table 1. Various levels of jack fruit pulp were incorporated with flour in the formulation of cake.

Table 1. Basic formulation of plain cake on 100 g flour basis

Formulations	Wheat flour (g)	Jackfruit pulp (g)	Sugar (g)	Fat (g)	Baking powder (g)	Egg (g)	Water (g)
Cake Containing 0% jackfruit pulp (Control)	100	0	40	40	3.5	35	50
Cake containing 5% jackfruit pulp	99	5	40	40	3.5	35	46
Cake containing 10% jackfruit pulp	98	10	40	40	3.5	35	42
Cake containing 15% jackfruit pulp	97	15	40	40	3.5	35	38
Cake containing 20% jackfruit pulp	96	20	40	40	3.5	35	34

* Jackfruit pulp contains approximately 80% water.

Procedure for preparation of cake

Cakes prepared by adding 0, 5, 10, 15 and 20% jackfruit pulp to basic formulation of cake were presented in Table 1. The flour, pulp and other ingredients for each cake were weighed accurately and the sugar and shortening were mixed in a mixer machine for 20 minutes to

produce a cream. In later stage, half of the water, other ingredients and finally the flour were mixed using a mixer at low speed (145rpm) for 10 minutes to ensure even distribution of the components. The bowl was scrapped and butter was mixed for an additional two minutes at medium speed. Portion of butter weighing 150 gm was scaled into pregreased cake pan. All cakes were backed in national forced convention oven for 40 minutes at 170^{O}C.

Estimation of moisture: The percent of moisture in the samples were estimated by the standard procedure as recommended by AOAC (2004).

Estimation of protein: The percent of protein (N X 5.7) present in the samples were determined by Microkjeldhal method as recommended by the AOAC (2004).

Estimation of ash, fat and sugar: The percent of ash, fat and sugar present in the samples were determined by standard procedure as recommended by the AOAC (2004).

Evaluation of physical characteristics of cake: Cake volume was initially used as important parameters of cake quality. The bread volume was determined by seed displacement method. The volume was measured by subtracting the volume of mustard seed required to fill the empty container from the measured volume of rapeseed required to fill a given container that held the bread for which volume was being determined. Weight, specific volume, loaf characteristics, crust characteristics and crumb characteristics of cake prepared from jackfruit pulp were carried out by using ISI methods (1972).

Sensory evaluation of cake

The symmetry and the characteristics of crust and crumb between the cakes prepared from incorporating with and without jackfruit pulp were evaluated for colour, flavour, texture and over all acceptability by 20 testers. The panelists were selected from the teachers, scientific officers, students and employers of the Department of Food Technology and Rural Industries, Bangladesh Agriculture University, Mymensingh and were briefed before evaluating sensory quality of the cakes. For statistical analysis of sensory data, a 1-9 point hedonic, rating test was used to assess the degree of acceptability of cake containing with different levels of jackfruit pulp. The highest score was 9 ‘like extremely’ and ‘dislike extremely’ was the lowest score of 1. The data were analyzed for ANOVA in completely randomized design (CRD) under computerized statistical methods of M-stat and least significant difference (LSD) was used to compare the means. The results were evaluated by Analysis of variance and Duncan's New Multiple Range Test procedures of the Statistical Analysis System (SAS, 1985)

RESULTS AND DISCUSSION

Proximate composition of jackfruit pulp

The jackfruit pulps were analyzed for moisture content, TSS, ash, protein, fat, reducing and non-reducing sugar and presented in Table 2. The result was similar to those obtained by Zaghlol *et. al*. (1983). They reported that the jackfruit pulp contain moisture 77.2%, TSS 20%, ash 0.88%, fat 0.1%, reducing sugar 6.80% and non-reducing sugar 8.98% respectively. The small variation may be due to varietals difference, agro-ecological condition and methods of analysis.

Table 2 Chemical composition of jackfruit pulp

Composition	Jackfruit pulp (%)
Moisture content (%)	78.00
Total soluble solid (%)	17.70
Ash content (%)	0.88
Crude fat (%)	0.10
Protein (%)	2.23
Reducing sugar (%)	10.21
Non-reducing sugar (%)	6.80

The effect of jackfruit pulp on the chemical composition of cake

Cakes prepared by incorporating various levels of jackfruit pulp were determined for moisture, protein, fat, ash and total sugar and the results are presented in Table 3.

Protein

It was observed from the Table 3 that protein content in cakes did not increase with the increasing amount of jackfruit pulp. The jackfruit content was approximately 2.23% protein whereas wheat flour contained 10.7% protein (Islam, 2004). Wheat flour contained higher level of protein than jackfruit.

Fat

The fat contents of the cake containing various levels of jackfruit pulp are presented in Table 3. The fat content of different cake samples did not vary. This is due to the fact that both jackfruit pulp and white flour contained little fat. Islam (2004) reported that wheat flour contain 0.9g fat/100g whereas jackfruit pulp contains 0.1g fat/100g of edible portion.

Ash

As shown in Table 3 the ash contents of the cakes containing jackfruit pulp were higher than that of cake containing without jackfruit pulp. It may be due to the addition of jackfruit pulp. The jackfruit pulp contained 0.88% ash whereas wheat flour contain 0.67%.

Total sugar

The total sugar content of different cake was 28.75 to 33.89% as shown in Table 3. It was observed that the total sugar content was the highest (33.89%) in the cake containing 20% jackfruit pulp and the lowest (28.75%) in the cake containing 0% jackfruit pulp. This increase of sugar content in cakes may be due to the addition of jackfruit pulp.

Moisture content

The moisture contents of the cake prepared with different level of jackfruit pulp are presented in Table 3. The cakes with jackfruit pulp had higher moisture contents than the cake prepared from wheat flour alone (20.12%). The moisture contents of the cake were progressively increased with increasing level of jackfruit pulp. This may be due to the fiber content in the jackfruit pulp. Berry *et. al.*, (1987) mentioned that the jackfruits are normally fibrous and are composed of mono,-di-, and polysaccharides.

Table 3. Proximate composition of cake containing jackfruit pulp at different level

Treatments	Protein (%)	Fat (%)	Ash (%)	Total sugar (%)	Moisture (%)
Cake containing 0% jackfruit pulp (Control)	7.26[a]	19.93[a]	1.19[c]	28.75[c]	20.12[e]
Cake containing 5% jackfruit pulp	7.20[a]	19.94[a]	1.23[c]	28.60[c]	22.52[d]
Cake containing 10% jackfruit pulp	7.15[a]	19.94[a]	1.34[b]	30.47[bc]	24.20[c]
Cake containing 15% jackfruit pulp	7.12[a]	19.96[a]	1.47[a]	32.18[ab]	25.48[b]
Cake containing 20% jackfruit pulp	7.08[a]	19.97[a]	1.53[a]	33.89[a]	27.91[a]
$LSD_{(0.05)}$	0.360	0.372	0.084	2.124	1.088
CV (%)	2.58	0.99	3.07	3.66	2.40

All figures are average of three replication.
Mean in column having the same letters are not significantly different at 5% probability level by DMART.

The effect of jackfruit pulp on physical properties of cake

Cake volume

It was observed from Table 4 that the volume of control cake gave higher volume (620cc) than that of all cakes prepared incorporating jackfruit pulp. Gluten is not present in jackfruit pulp so the volume of cake progressively decreased with the increasing level of jackfruit pulp in the formulation.

Weight of cake

The weight of the cake prepared by different levels of jackfruit pulp in the formulation of cake are measured and presented in Table 4. It was observed that the weight of cake prepared from jackfruit pulp was increased with the increased of pulp in dough. The lowest weight (377g) was observed in cakes without jackfruit pulp. The higher weight in jackfruit cake may be due to the higher fiber and pectin content those are contributed by the jackfruit pulp in the dough. These might hold the water which may contribute to the higher weight of the jackfruit cake.

Specific volume of cake

The specific volumes of the different cake are presented in Table 4. The result varied from 1.54 to 1.64 cc/g and specific volume gradually decreased with increasing level of jackfruit pulp in the cake formulation.

The effects of jackfruit pulp on external and internal characteristics of cake

External characteristics

External characteristics of cake containing different levels of pulp are shown in Table 6. It was observed that the control cakes had better symmetry compared to other cakes. The crust colour of the cake above 10% added jackfruit pulp were darker than those of control cakes and cake containing 5% jackfruit pulp (light brown). This may be due to the carotene in jackfruit pulp. Hossain *et. al*. (1979) stated that jackfruit contained 250-1740 mg carotene per 100g of edible portion. The tender of cake were obtained in the cake containing 0, 5 and 10% jackfruit pulp and rests of them were medium tender. The overall crust characteristics of cakes containing 10% jackfruit pulp seemed to be better than those of higher jackfruit pulp. This may be due to the presence of pectin in the jackfruit pulp.

Table 4. Effect of jackfruit pulp on volume, weight and specific volume of the cake

Treatments	Volume (cc)	Weight (g)	Specific volume (cc/g)
Cake containing 0% jackfruit pulp (Control)	620[a]	377[e]	1.64[a]
Cake containing 5% jackfruit pulp	618[a]	382[d]	1.62[ab]
Cake containing 10% jackfruit pulp	615[b]	385[c]	1.60[abc]
Cake containing 15% jackfruit pulp	611[b]	389[b]	1.57[bc]
Cake containing 20% jackfruit pulp	602[c]	392[a]	1.54[c]
$LSD_{(0.05)}$	4.970	1.331	0.059
CV (%)	0.43	0.18	2.13

All figures are average of three replication.
Mean in column having the same letters are not significantly different at 5% probability level by DMART.

Internal characteristics

Crumb colour

Crumb colours of the cakes containing jackfruit pulp at various levels are presented in Table 6. Cake containing jackfruit pulps above 10% were generally more deep yellowish than the control cake. As a whole, the cake containing 10% jackfruit pulp had better crumb colour. A significant texture difference was observed between control and jackfruit pulp added cakes and this difference increased above 10% substitution levels. A perfect texture should be free from lumps and harshness and have a smooth silky surface which was obtained in the control samples and 10% jackfruit pulp added cake samples. The odour of the cakes containing 15% and 20% jackfruit pulp were generally natural and was not desirable. The acceptable odour (that is fresh, sweet, natural appetizing) was found in cake containing 0% and 10% jackfruit pulp. The cakes containing 15% and 20% jackfruit pulp had coarser grain and non-uniform shape and size. But the cakes containing 10% jackfruit pulp and without jackfruit pulp had equally acceptable crumb grain.

The effect of jackfruit pulp on sensory quality of cake

The effect of jackfruit pulp on colour, flavour, texture and overall acceptability by the panel judges of cakes are presented in Table 5. A two-way analysis of variance (ANOVA-2) was carried out and results revealed that there was significant ($P<0.05$) differences in overall acceptability among the cakes. The results indicated that the overall acceptability (Table 6) of the control cakes (without jackfruit pulp) gave the highest score (8.05) and followed by cake containing 10% (7.40) and 5% (6.85) jackfruit pulp considering colour, flavour and texture. Their crust has light brown colour, medium edge and its crumb has yellowish colour, smooth surface and uniform grain size. The cake containing 20% jackfruit pulp secured the lowest

score (4.50) and was not acceptable to the panelists. It may be due to the uneven, low edge crust and silky texture, non-uniform size and gray yellowish crumb colour.

Table 5. Effect of jackfruit pulp on colour, flavour, texture and overall acceptability of the cake

Treatments	Mean scores on			
	Colour	Flavour	Texture	Overall acceptability
Cake containing 0% jackfruit pulp (Control)	8.15[a]	8.05[a]	8.40[a]	8.05[a]
Cake containing 5% jackfruit pulp	7.10[b]	6.95[ab]	7.00[bc]	6.85[ab]
Cake containing 10% jackfruit pulp	7.40[b]	7.90[a]	7.55[b]	7.40[a]
Cake containing 15% jackfruit pulp	6.55[c]	6.90[ab]	6.40[c]	6.05[b]
Cake containing 20% jackfruit pulp	5.70[d]	6.20[b]	5.15[d]	4.50[c]
$LSD_{(0.05)}$	0.434	1.096	0.613	1.075
CV (%)	3.31	8.09	4.71	8.87

All figures are average of three replication.
Mean in column having the same letters are not significantly different at 5% probability level by DMART.

Table 6. The effect of jackfruit pulp on symmetry, crust and crumb characteristics of cake

Treatments	External characteristics					Internal characteristics (Crumb)					
	Symmetry			Crust characteristics			Texture		Odour	Grain	
	Evenness	Edges	Centre	Colour	Consistency	Colour	Lumps and harshness	Surface		Close or airy	Shape and size
Cake containing 0% jackfruit pulp (Control)	Even	Medium	Medium	Light brown	Tender	White yellow	Free	Smooth silky	Appetizing	Close	Uniform, thin walled cells
Cake containing 5% jackfruit pulp	Even	Medium	Low	Light brown	Tender	Yellowish	Free	Smooth	Appetizing	Close	Uniform
Cake containing 10% jackfruit pulp	Even	Medium	Medium	Brownish	Tender	Yellowish	Free	Smooth	Appetizing	Close	Uniform
Cake containing 15% jackfruit pulp	Uneven	Low	Low	Brown	Medium tender	Deep yellow	Present slightly	Not smooth	Not fresh	Slight airy	Thick walled cell
Cake containing 20% jackfruit pulp	Uneven	Too low	Low	Deep brown	Medium tender	Gray yellowish	Present slightly	Not smooth and silky	Natural	Slight airy	Non-uniform

CONCLUSION

From the study, it was observed that the cakes incorporated with 10% jackfruit pulp had better bloom, crust colour and texture compared to other cakes containing of jackfruit pulp. So, steps should be taken for dissemination of this technology in food industries for preparing cake.

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