# Influence of Jackfruit Pulp on the Quality and Shelf Life of Jackfruit Cake

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**Abstract**

This study was designed to develop cakes incorporating jack-fruit pulp. The seed free jackfruit bulbs blend were used at the level of 10%, 20%, 30% and 40% to prepare jackfruit cake The physical and chemical properties of cakes were analyzed and compared with plane cake (without jack-fruit pulp).The cake containing 10% jack-fruit pulp was best among the samples on the basis of rust and crumb colour and texture of the cakes..The flavours of the cake containing 20% jack-fruit pulp were better than other cakes. The statistical analysis of organoleptic test response of sensory attributes revealed that colour, flavour, taste, texture and overall acceptability werehigher in the cakes containing 10% and 20% jackfruitpulp than normal cake.Shelf life of jack-fruitcakes were decreased with the increased level of substitution of jackfruit pulp during seven day storage on the basis of microbial count.Cake containing 10% jack-fruit showed acceptable physical characteristics, sensory attributes and microbial load.

**Key words:** Cake, Jackfruit cake, Jackfruit pulp, Shelf life

## Introduction

Jackfruit is an ancient fruit that is widely consumed as a fresh fruit. Jackfruit (*Artocarpus heterophyllus* Lam.) trees belong to the family Moraceae. They are predominantly found in Southeast Asia, particularly in tropical regions of countries such as India and Bangladesh (Rahman *et al*., 1999). It is designated as the national fruit of Bangladesh.It is a huge, spiny, oval shaped fruit.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, 540 $mg100g^{-1}$ vitamin-A and 30mg thiamine $100g^{-1}$ of edible portion of jackfruit.Jackfruit contains significant amount of various valuable nutrients and hence it could play an important role for the improvement of malnutrition problem in Bangladesh.The functional components of jackfruit to reduce the various diseases such as lowering blood pressure, preventing heart disease and strokes, preventing bone loss and improving muscle and, nerve function, reducing homocysteine levels in the blood. Another heart-friendly property found in the jackfruit is due to vitamin B6 that helps reduce homocysteine levels in the blood thus lowering the risk of heart disease (Siddappa, 1957). Vitamin C is vital to the production of collagen, a protein that provides skin with structure and gives it its firmness and strength (Babitha *et al*., 2004).The presence of high fiber content (3.6 g $100g^{-1}$) in the jackfruit prevents constipation and produces smooth bowel movements. It also offers protection to the colon mucous membrane by removing carcinogenic chemicals from the large intestine (colon) (Siddappa,1957). Jackfruit is rich in magnesium (27 mg $100g^{-1}$ in young fruit and 54 $mg100g^{-1}$ in seed) (Gunasena *et al*., 1996). It is a nutrient important in the absorption of calcium and works with calcium to help strengthen the bone and prevents bone-related disorders such as osteoporosis (Singh *et al*., 1991). Jackfruit also contains iron (0.5 $mg100g^{-1}$), which helps to prevent anemia and also helps in proper blood circulation (Singh *et al*., 1991). Jackfruit is very popular and nutritious fruit. In Bangladesh the climate is very suitable for the cultivation ofjackfruit and economically available, hence designated as a national fruit. Every year a large amount of jackfruit is growing in our country and its proper uses, processing and preservation is necessary. The utilization of jackfruit pulp in an industrial level is important for product market strategy.Taking those points in consideration, the study was undertaken to development and evaluation of value added fruitcake based on jackfruit pulp.

## Materials and Methods

### *Collection and storage of jackfruit*

The jackfruits were collected from the local market ofTangail district during the season. The experimental studies were carried out in the laboratory of Food Technology and NutritionalScience department at Mawlana Bhashani Science and Technology University in Bangladesh.

### *Preparation of jackfruit pulp*

In making the jackfruit pulp, first we collected jackfruit from the nearby market.Then we let the jackfruit to ripe.Then jackfruit is cracked open,we got pods or "bulbs"inside it.It is often referred to as the seeds; these bulbs are actually a kind of fleshy covering for the true seeds or pits, which are round

and dark like chestnuts. The ripe fleshy part (the "bulb") is taken by removing the true seed inside it.The bulbs are then blended by using a blender to make juice.

***Ingredients used for preparing fruitcake***

| Ingredient | Amount |
|---|---|
| Total flour | 250g |
| Egg | 2pcs |
| Sugar | 166g |
| Oil | 33g |
| Baking powder | 30g |
| Milk powder | 5g |
| Salt | 2g |
| Glucose | 5g |
| Water | 83g |

***Fruitcake preparation***

The production of composite fruitcake the amount of jackfruit pulp levels included 10, 20, 30 and 40% of total flour. Firstly, the seeds were taken out of each of the jack fruit bulb. The jack fruit bulb pieces (without the seeds of course) were placed in a blender and blended well. On the other, eggs were beaten by using beater and slowly sugar was added and mixed well. Then, baking powder was added to that mix. Then add oil, salt, glucose, milk poder and water one by one and mix well by using mixer. The remaining flour and other ingredients were then transferred into the 5 liters capacity dough mixer. The flour plus the other ingredients were first mixed with the water for 2 minutes at speed 1 (lowest speed) in the dough mixer equipped with a hook attachment, after that the speed was changed to speed 2 (medium speed) and continue mixing for 10 minutes. Pour the jackfruit pulp juice on the basis of 0%, 10%, 20%, 30% and 40% in the resulting mix, stir and mix well. Pre-heat the cake tray for 10 minutes at 180 degree Celsius and grease the oil on it. Pour the mixture on the tray. Bake in an oven at 180 degree Celsius for 30-40 minutes. The method used was modified method used by Nadira Begum. Fruitcake was also prepared by using whole wheat flour as control. Five minutes after removed from the oven, the fruitcake was removing from the pan and allowed to cool to room temperature for 1 hour and then packed in the moisture and vapor proof polyethylene bag. The packed fruitcake was kept in the room temperature overnight for use in physical and sensory evaluations.

***Proximate compositional analysis***

Moisture content and ash content of plane cake and jackfruit cake were determined by AOAC (1984). Fat was estimated by dissolving the food sample into organic solvents (chloroform: methanol) separating the filtrate by filtration, placing the filtrate into separating funnel and then separated mixture is then dried to measure the extract andfinally % of fat is estimated. Percent (%) of fat content=weight of theextract×100. Total nitrogen content was estimated by Kjeldhal method (AOAC, 1984). The protein contain of a product were obtained by multiplying the nitrogen value by 6.25.

***Sensory evaluation of fruitcake***

Sensory evaluation of the composite fruitcake samples were carriedout by 10 panelists on a 9 point hedonic scale for differentparameters such as color, aroma, taste, texture and overallacceptability. The 10 untrained panelists were teachers and students of Food Technology and Nutritional Science Department of MBSTU, Bangladesh. Age ranges 20-35 years.

***Physical properties of fruitcake samples***

***Hardness of fruitcake***

Hardness means the force required to compress the material by a given amount. Hardness of fruitcake was observed by the panelist using the scale of 1-7 where 1 denotes the most soft fruitcake texture and 7 denotes the most hard fruitcake texture.

***Springiness of fruitcake***

Springiness of fruitcake means the elastic recovery that occurs when the compressive force is removed. It was observed by the panelist using the scale of 1-5 where 1 denotes low elastic and 5 denotes highelastic range of springiness.

***Microbial analysis***

***Bacteriological and fungal experimentation***

In this study, bacterial and fungal standard plate count (SPC) was performed for 0%, 10%, 20%, 30% and 40% fruitcake sample.

## Results and Discussion

***Composite Fruitcake Analysis (nutritional value of composite fruitcake)***

Cake with wheat flour alone and with the addition of jackfruit pulp were evaluated for nutritional value as shown in Table 1. Result showed that the proximate values for protein, fat, ash, CHO and energy value were highest in wheat cake, which served as control and lower in jackfruit pulp substituted samples. The proximate values decreased with increasing levels of jackfruit pulp substitutions. This may be due to jackfruit contain high moisture low fat and protein content.

***Sensory evaluation of fruitcake with jackfruit pulp***

The acceptability of composite wheat and jackfruit pulp fruitcake were determined in terms of sensory evaluation. The panelists were selected from the student, teacher, and employee of the department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Tangail. The Panelists were request to assigned appropriate score for general appearance and overall acceptability of fruitcake.

**Table 1**. Nutritional values of composite fruitcake with whole wheat flour andfruitcake with jackfruitpulp

| Substitution % | Moisture% | Protein % | Fat% | Ash % | CHO % | Energy Value(kcal/ 100gm) |
|---|---|---|---|---|---|---|
| Normal | 14.8752 | 7.33 | 20.2 | 1.66 | 55.93 | 434.85 |
| 10% JFP | 18.2547 | 7.22 | 18.76 | 1.63 | 54.14 | 414.26 |
| 20% JFP | 22.756 | 7.07 | 17.556 | 1.61 | 51.01 | 390.32 |
| 30% JFP | 24.658 | 6.90 | 16.286 | 1.55 | 50.61 | 376.60 |
| 40% JFP | 27.041 | 6.85 | 14.56 | 1.50 | 50.05 | 358.634 |

**JFP= Jackfruit pulp*

Based on sensory data, the overall acceptability scores ranged from 5 to 7.5 (like moderately to neither like or dislike) as shown the Fig. 1.

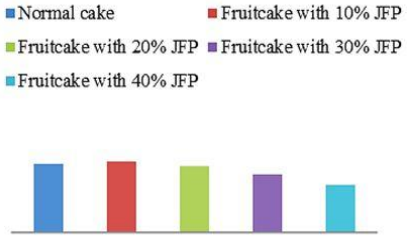


**Fig. 1**. Overall acceptability of composite fruitcake

The results indicated that the overall acceptability of jackfruitcake was decreased with the increase of jackfruitpulp. Fruitcake containing 10% jackfruitpulp wasfound highest score (7.5) of overall acceptability and 40% jackfruit pulp containing cake was lowest score (5.0). Fruitcake produced from 20% and 30% jackfruitpulp showed medium scores.However, fruitcake containing up to 10% jackfruitpulp were most acceptable in terms of sensory evaluation. The higher amount of jackfruit pulp was not accepted by the consumer in terms of overall internal and external appearances.

***Storage study of fruitcake***

***Storage study of composite fruitcake in ambient temperature and refrigerated temperature***

The samples of fruitcake (0%, 10%, 20%, 30% and 40%) were stored at ambient temperature (30ºC) and at refrigerated temperature (4-6 °C) for the period of seven days for storage study. During storage the change in color, flavor and texture of cakes were observed. Table 2 and 3 showed the storage study of fruitcake. Table revealed that 40% jackfruit cake was rejected by panelist based on colour, flavor and texture.

***Fruitcake crumb hardness***

The data for composite fruitcake hardness are presented in Table 4. Results indicate that the hardness of fruitcake was decrease with the increase of jackfruit pulp level. About 40% jackfruit pulp substitute level, the highest used in this study, gave lowest hardness of composite fruitcake.

**Table 2.** Storage study of fruitcake in ambient temperature

| Period of storage(Days) | Percentage of fruit pulp fruitcake | Observation | | | Remarks |
|---|---|---|---|---|---|
| | | Color | Flavor | Texture | |
| 1 | 0 | Light Yellow | Satisfactory | Soft | Good quality |
| | 10 | Light Yellow | Satisfactory | Soft | Good quality |
| | 20 | Light Yellow | Satisfactory | Soft | Good quality |
| | 30 | Light Yellow | Satisfactory | Soft | Good quality |
| | 40 | Deep yellow | Unsatisfactory | More soft | Bad quality |
| 3 | 0 | Light Yellow | Satisfactory | Soft | Good quality |
| | 10 | Light Yellow | Satisfactory | Soft | Good quality |
| | 20 | Light Yellow | Satisfactory | Soft | Good quality |
| | 30 | Light yellow | Unsatisfactory | Soft | Good quality |
| | 40 | Deep Yellow | Unsatisfactory | More soft | Bad quality |
| 5 | 0 | Deep yellow | Satisfactory | Soft | Good quality |
| | 10 | Deep yellow | Satisfactory | Soft | Good quality |
| | 20 | Deep Yellow | Satisfactory | Soft | Good quality |
| | 30 | Deep yellow | Unsatisfactory | More soft | Bad quality |
| | 40 | Deep yellow | Unsatisfactory | More soft | Bad quality |
| 7 | 0 | Deep yellow | Satisfactory | Soft | Good quality |
| | 10 | Deep yellow | Unsatisfactory | Soft | Good quality |
| | 20 | Deep Yellow | Unsatisfactory | More soft | Bad quality |
| | 30 | Deep yellow | Unsatisfactory | More soft | Bad quality |
| | 40 | Deep yellow | Unsatisfactory | More soft | Bad quality |

**Table 3**. Storage study of composite fruitcake in refrigeration temperature

| Days | (%) Jackfruit | Observation | | | Remarks |
|---|---|---|---|---|---|
| | | Color | Flavor | Texture | |
| 1 | 0 | LightYellow | Satisfactory | Soft | Good quality |
| | 10 | LightYellow | Satisfactory | Soft | Good quality |
| | 20 | LightYellow | Satisfactory | Soft | Good quality |
| | 30 | LightYellow | Satisfactory | Soft | Good quality |
| | 40 | LightYellow | Unsatisfactory | Soft | Bad quality |
| 3 | 0 | LightYellow | Satisfactory | SlightHard | Good quality |
| | 10 | LightYellow | Satisfactory | SlightHard | Good quality |
| | 20 | LightYellow | Satisfactory | Soft | Good quality |
| | 30 | LightYellow | Satisfactory | Soft | Good quality |
| | 40 | LightYellow | Unsatisfactory | Soft | Bad quality |
| 5 | 0 | LightYellow | Satisfactory | SlightHard | Good quality |
| | 10 | LightYellow | Satisfactory | SlightHard | Good quality |
| | 20 | LightYellow | Satisfactory | SlightHard | Good quality |
| | 30 | DeepYellow | Satisfactory | Soft | Good quality |
| | 40 | DeepYellow | Unsatisfactory | Soft | Bad quality |
| 7 | 0 | DeepYellow | Satisfactory | Hard | Not Good |
| | 10 | DeepYellow | Satisfactory | Hard | Not Good |
| | 20 | DeepYellow | Satisfactory | Hard | Not Good |
| | 30 | DeepYellow | Satisfactory | Slight Soft | Good quality |
| | 40 | DeepYellow | Unsatisfactory | Slight Soft | Bad quality |

***Fruitcake crumb springiness***

Data for springiness of composite jackfruit pulp fruitcake are presented in Table 5. . Plain cake (0% jackfruit pulp) showed highest springiness and cake containing 40% jackfruit pulp showed lowest springiness after 7 days of storage. It was clearly observed that the springiness of composite fruitcake contain jackfruit pulp decreased with increased of substitution level of jackfruit pulp.

**Table 4**. Effect of levels of jackfruit pulp on composite fruitcaketexture (Hardness) changes during seven day storage at ambient temperature

| % of substitution | Hardness at ambient temperature | | | |
|---|---|---|---|---|
| | 1st day | 3rd day | 5th day | 7th day |
| 0% JFP | 6 | 5 | 4.5 | 4 |
| 10% JFP | 5.5 | 5 | 4.5 | 4 |
| 20% JFP | 5 | 4 | 3.5 | 3 |
| 30% JFP | 4 | 3.5 | 3 | 2.5 |
| 40% JFP | 3 | 2.5 | 2 | 1.5 |

*JFP= Jackfruit pulp*

**Table 5.** Effect of levels of jackfruit pulp on composite fruitcaketexture (Springiness) changes during ambient temperature storage

| % of substitution | Springiness at ambient temperature | | | |
|---|---|---|---|---|
| | 1st day | 3rd day | 5th day | 7th day |
| 0% JFP | 5 | 4.5 | 4 | 3.5 |
| 10% JFP | 5 | 4.5 | 4.2 | 3.5 |
| 20% JFP | 4.5 | 4 | 3.5 | 3 |
| 30% JFP | 4 | 3 | 2.5 | 2 |
| 40% JFP | 3 | 2.5 | 2 | 1.5 |

*JFP= Jackfruit pulp; the scale of 1-5 where, 1 denotes low elasticity and 5 denotes high elasticity*

***Microbiological quality***

***Total bacteria and yeast count at ambient temperature***

In fruitcake, the total viable bacterial count slowly increased during seven days storage at ambient temperature. If we collect samples aseptically after cooking then there should not be any bacteria and fungus. But it is not possible, because the entire sample come to contact with air during handling or eating. So that some spores will grow on it. I have got very small amount of bacterial and fungal contamination in fruitcake samples probably due to contact with air. The bacteria increase after two days was significant in 40% fruitcake with jackfruit pulp. The increase in bacteria was significant in 20%, 30% and 40% fruitcake after four days. After six days this count is significant in 10%, 20%, 30% and 40% jackfruit pulp enriched fruitcake.

A significant increase in total yeast and mold count was observed for fruitcake during the storage period. In fruitcake after 3 days of storage there was visible yeast growth on the surface of 40% fruitcake which was not acceptable. After 5 days of storage there was visible yeast and moldgrowth on the surface of 20%, 30% and 40% jackfruit pulp enriched fruitcake which was also not acceptable. The 10%, 20%, 30% and 40% jackfruit pulp rich fruitcake became unacceptable after 7 days of storage due to yeast and mold growth.

**Table 6.** Microbial count (bacteria) at ambient temperature

| % substitution | 1st day (cfu $gm^{-1}$) | 3rdday (cfu $gm^{-1}$) | 5thday (cfu $gm^{-1}$) | 7th day (cfu $gm^{-1}$) |
|---|---|---|---|---|
| 0% JFP | 18000 | 20000 | 24000 | 33000 |
| 10% JFP | 20000 | 23000 | 28000 | 30000 |
| 20% JFP | 21000 | 27000 | 32000 | 34000 |
| 30% JFP | 19000 | 33000 | 40000 | 43000 |
| 40% JFP | 23000 | 39000 | 42000 | 45000 |

*JFP= Jackfruit pulp*

**Table 7.** Microbial count (yeastand mold)at ambient temperature

| % substitution | 1st day (cfu $gm^{-1}$) | 3rd day (cfu $gm^{-1}$) | 5thday (cfu $gm^{-1}$) | 7thday (cfu $gm^{-1}$) |
|---|---|---|---|---|
| 0% JFP | 11000 | 13000 | 19000 | 27000 |
| 10% JFP | 13000 | 24000 | 27000 | 33000 |
| 20% JFP | 17000 | 21000 | 29000 | 46000 |
| 30% JFP | 14000 | 26000 | 33000 | 55000 |
| 40% JFP | 11000 | 29000 | 39000 | 79000 |

*JFP= Jackfruit pulp*

***Total bacterial and yeast count at refrigerated temperature***

In fruitcake, the total viable bacterial count slowly increased during seven days storage at refrigerated temperature. The bacteria increase after two days was significant in 40% fruitcake with jackfruit pulp. The increase in bacteria was significant in 20%, 30% and 40% fruitcake after four days. After sixdays this count is significant in 10%, 20%, 30% and 40% jackfruit pulp enriched fruitcake. A significant increase in total yeast and mold count was observed for fruitcake during the storage period. In fruitcake after 3 days of storage there was yeast and mold growth on the surface of 40% fruitcake which was not acceptable. After 5 days of storage there was yeast growth on the surface of 20%, 30% and 40% jackfruit pulp enriched fruitcake which was also not acceptable. The 10%, 20%, 30% and 40% jackfruit pulp rich fruitcake became unacceptable after 7 days of storage due to yeast and mold growth.

**Table 8.** Microbial count (bacteria) at refrigeration temperature

| % of substitution | 1st day (cfu $gm^{-1}$) | 3rd day (cfu $gm^{-1}$) | 5th day (cfu $gm^{-1}$) | 7th day (cfu $gm^{-1}$) |
|---|---|---|---|---|
| 0% JFP | 15000 | 19000 | 23000 | 27000 |
| 10% JFP | 19000 | 22000 | 27000 | 31000 |
| 20% JFP | 19000 | 26000 | 31000 | 34000 |
| 30% JFP | 20000 | 28000 | 35000 | 37000 |
| 40% JFP | 21000 | 31000 | 39000 | 41000 |

*JFP= Jackfruit pulp*

**Table 9.** Microbial count (yeast and mold) at refrigeration temperature

| % of substitution | 1stday (cfu $gm^{-1}$) | 3rdday (cfu $gm^{-1}$) | 5thday (cfu $gm^{-1}$) | 7thday (cfu $gm^{-1}$) |
|---|---|---|---|---|
| 0% JFP | 13000 | 20000 | 23000 | 27000 |
| 10% JFP | 12000 | 21000 | 20000 | 31000 |
| 20% JFP | 10000 | 17000 | 26000 | 31000 |
| 30% JFP | 8000 | 19000 | 29000 | 35000 |
| 40% JFP | 6000 | 23000 | 31000 | 39000 |

*JFP= Jackfruit pulp*

## Conclusions

Jackfruit pulp based fruitcake were formulated at the level of 10%, 20%, 30% and 40%, compared with whole wheat flour cake comparison was done in case of nutritional quality and sensory quality. Fruitcake with 10% jackfruit pulp was slightly different from 100% wheat flour cake. It has been found that fruitcake with 10% and 20% pulp was significant in most sensory attributes and moderately acceptable. Fruitcake from 30% and 40% composite pulp showed low means score attributes. Hardness decreases when increases jackfruit pulp in composite fruitcake. The enrichment of fortified fruitcake and other cereal based confections with jackfruit pulp plays a significant role in the improvement of product value due to increasing sensorial result. On the other hand fruitcake that is fortified with jackfruit pulp is also helpful to our health and reducesthe risk of heart disease and obesity because it is lowest in fat content.

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