

# UTILIZATION OF BREADFRUIT (*Altocalpus altilis*) FLOUR INTO BAKED PRODUCTS

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## **ABSTRACT**

*The overall objective of the study is to develop breadfruit (*Altocalpus, altilis*) as an additional source of flour in baked products. The matured and unripe breadfruits were washed in clean running water to remove latex and dirt. Then the fruits were peeled manually using a stainless kitchen knife. Peeled fruits are sliced into chips, weighed and blanched for 5 minutes then dried in hot air oven at 100oF for 5-6 hours. The dried chips were ground using electric grinder. The product was used to bake a pie crust, cookies, and batter cake. Sensory evaluations were conducted as well as cost benefit analysis, with the breadfruit flour yielding favorable results for each. Comparisons with existing products were also done, with the breadfruit flour gaining a slightly higher adjectival rating than existing products. Overall, it is concluded that breadfruit ) is a good source of flour for baked products.*

**Keywords:** breadfruit, flour, food

## **INTRODUCTION**

Breadfruit (*Altocalpus, altilis*) is one of those fruits that has been called poor man's crop. The tree produces fruit twice a year, from March to June and from July to September, with some fruiting throughout the year (Omobuwajo & Wilcox, 1989). The fruit is highly nutritious as a valuable food source of its high caloric content (68% starch, 4% protein, 1% fat on dry weight basis) and has significant amounts of some vitamins and minerals. It is rich in carbohydrates and is also an excellent source of calcium, magnesium, vitamin A, protein among others (FilipiKnow, 2013). Even though breadfruit is highly nutritious it has long been unexploited in the Philippines due to unawareness of its productivity as edible fruit. In some countries like in Nigeria, it became a staple food because of tenacious food shortages and because it can be prepared into same food forms as yam. There are reports of some evidenced food applications of breadfruit. For instance, a commercial dehydration of breadfruit for use as food (Reeve, 1973). Breadfruit flour was also used as adjunct to malted sorghum in the production of non-alcoholic beverages (Ilori and Irefin, 1997).

According to Malvar (2014) breadfruit has high content of starch because of its weight and they

experimented and made a couple of research about it. It may have characteristics of some properties of wheat flour. Olatunji and Akinrele (1978) studied that there are no great changes in rheological, dough Properties and bread qualities of bread flour as a component of composite flour and concluded that a 10% substitution of wheat flour with breadfruit flour. Everyone may seem interested on the differences of every flour and makes sense to specific flour in any standardized recipes. All of the flours in the market are made of wheat and the differences that they have is that they are milled and the kind of wheat they're made from and even the time of the year that they are harvested but the main thing that really makes them different is the protein content. To get a light and airy structure of cakes it needs a little protein that contributes to the structure. The quality attributes of the products tend to decrease with corresponding increase in the percentage substitution of up to 10-15 % of composite flour in the production of baked products will go a long way in reducing cost and enhance utilization.

This study will use breadfruit as alternative source of flour which can be used as additional source of flour for nutritious baked products.

## OBJECTIVES OF THE STUDY

The aim of the study is to develop flour from breadfruit for baked products. Specifically, to:

1. Develop a protocol for development of breadfruit flour for batter cake, pie crust and pressed cookies;
2. Evaluate the sensory attributes of the breadfruit flour for batter cake, pie crust and pressed cookies in terms of appearance, flavour and texture; and
3. Determine the cost benefit analysis of the baked products.

## METHODS

### Materials

Breadfruit were purchased in the local market of Goa, Camarines Sur including wheat flour, shortening, sugar, milk, eggs and salt.

### Methods

#### Production of Breadfruit flour

The matured and unripe breadfruits were washed in clean running water to remove latex and dirt. Then the fruits were peeled manually using a stainless kitchen knife. Peeled fruits are sliced into chips, weighed and blanched for 5 minutes then dried in hot air oven at 100oF for 5-6 hours. The dried chips were ground using electric grinder. The ground breadfruit were packed into polyethylene bags.

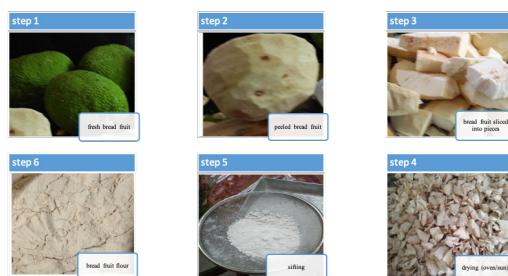


Figure 1. Flow chart of the processing of bread fruit into flour

Figure 1 shows the entire process of making flour from breadfruit. During the process, it was observed that the fresh whole breadfruit weighted 3,430 gram and the removal of the skin peeling and core, the sample decreased weight to 2,650 grams. At least 77.25% of the mass of the breadfruit were wasted as peelings. When

dried in the oven, the sample weighed only 500 grams. At this point, 81% of the moisture has been removed during the process. When grinded the weight of the samples is the same and this is true to sun and oven dried.

#### Breadfruit flour into baked products

The breadfruit flour was processed into three baked products namely: breadfruit batter cake, breadfruit pie crust and breadfruit pressed cookies following standard recipes.

#### A. Breadfruit Batter Cake

##### Ingredients:

- 1 cup (2 sticks) unsalted butter.
- 1 3/4 cups sugar.
- 4 large eggs plus 2 large egg yolks.
- 1 tablespoon pure vanilla extract.
- 3 cups cake flour (following different percentage)
- 1 tablespoon baking powder.
- 1/2 teaspoon fine salt.
- 1 1/2 cups buttermilk.

#### Procedure in Making Breadfruit Batter Cake

1. Place the butter in the mixing bowl & beat rising a wooden spoon until it is smoother and creamy.
2. Add the sugar & cream the mixture until light and fluffy.
3. Add the eggs one at a time, beating well after each addition until fluffy.
4. Add the sifted dry ingredients alternately with the liquid ingredients, repeat until all dry & liquid ingredients are used
5. Scrape down the sides of the bowl from time to time for even mixing
6. Bake for 30 minutes.

Seven proportion of breadfruit flour with wheat flour in the percentage of 100:0, 75:25, 60:40, 50:50, 0:100, 25:75, 40:60 was tried.

#### B. Breadfruit Pie Crust

##### Ingredients:

- 2 1/2 cup flour (following different percentage)
- 2 tsp sugar
- 1/2 tsp salt
- 2/4 cup shortening
- 6 – 8 tbsp. cold water

#### Procedure in Making Breadfruit Pie Crust

1. Preheat the oven to 350°C.

2. Sift flour, sugar and salt into a bowl.
3. Cut in shortening with dull-edged knives until particles are pea sized.
4. Add cold water gradually tossing gently with a fork, pushing aside the moisture flour to one side.
5. Add just enough water to moister all the flour.
6. Form into a bowl. Roll dough at the center into  $\frac{1}{2}$  inch thick.
7. Fit pastry into the bottom of the piecrusts.
8. Bake for 10 minutes.

*C. Breadfruit Pressed cookies*

**Ingredients:**

1 1/3 cake flour (following different percentage)  
 1/2 cup butter  
 2/3 cup sugar  
 1/4 cup egg white  
 1/2 tsp vanilla

*Procedure of Making Breadfruit Pressed Cookies*

1. Cream the butter. Add sugar gradually.
2. Add egg white gradually beating well after each addition.
3. Add the flour, mix well. Blend in vanilla.
4. Pipe cut from small plain tip. Press cut thin strip of batter about 2 long.
5. Spare between cookies or spreading.
6. Bake 7 min or until golden brown.
7. Loosen, let it cool.

Seven proportion of breadfruit flour with wheat flour in the percentage of 100:0, 75:25, 60:40, 50:50, 0:100, 25:75, 40:60 was tried.

**Sensory Evaluation of Breadfruit Products**

The sensory attribute, including texture, taste, appearance was evaluated by using a 9-point Hedonic scale. The hedonic analysis described the degree of consumer's acceptability and satisfaction regarding the product. The evaluators of the baked products are the 15 panelists purposively selected within the University community. Water at room temperature was provided to rinse the mouth between evaluations. The control was cookies made from 100% wheat flour.

**Cost Analysis of the Product**

The total cost of the product was determined by adding direct cost of the materials, labour cost and

overhead expenses which include the indirect materials used and the indirect labour cost. The desired mark-up was 40% of the total cost from which the selling cost of the product was determined. The gross profit rate was computed by dividing the gross profit (GP) by the total sales and the return of investment (ROI) was computed by dividing the profit by the total investment.

## **RESULTS AND DISCUSSION**

### **Breadfruit Batter Cake**

From the result of the sensory evaluation, the best ratio for Cake Flour (CF): Breadfruit Flour (BF) is 25:75 with an average of 7.2, although cake flour is rated 7.5, yet their adjectival rating is the same, Like very much (Table 1).

Table 1. Sensory Evaluation Results of Breadfruit Batter Cake

Batter Cake	BC1 100% C F	BC2 25-75 CF BF	BC3 50-50 CF- BF	BC4 40-60 CF-BF	BC5 60-40 CF- BF	BC6 75-25 CF BF	BC7 100% B F
Appearance	7.4	7.2	6.7	6.5	6.7	6.7	5.8
Flavor	7.5	7.5	6.6	6.9	6.8	6.6	5.6
Texture	7.7	7.0	6.2	6.9	6.2	6.2	5.2
<b>Average</b>	<b>7.5</b>	<b>7.2</b>	<b>6.5</b>	<b>6.7</b>	<b>6.5</b>	<b>6.5</b>	<b>5.5</b>
Adjectival Rating	Like Very Much	Like Very Much	Like Moderately	Like Moderately	Like Moderately	Like Moderately	Like Slightly

### Breadfruit Pie Crust

Table 2 shows the sensory evaluation results for Breadfruit Pie Crust. It is gleaned in the table that the Breadfruit Flour: Cake Flour ratio at 25:75 is more acceptable, although the results seemed to be low, yet is has the same result with 100% Breadfruit Flour which

is 6.5 or Like Moderately.. This product seemed to be less appreciated since it has no pie filling yet, but the characteristic of the crust is crunchy.

Table 2. Sensory Evaluation Results for Breadfruit Pie Crust

Pie Crust	Pc1 100% B F	PC2 25:75 BF:CF	PC3 100% C F	PC4 50-50 CF-BF	PC5 75-25 CF-BF	PC6 40-60 CF-Bf	PC7 60-40 CF- BF
Appearance	7.1	6.6	5.8	6.4	6.4	6.4	6.5
Taste/ Flavour	6	6.06	5.8	5.5	5.8	5.8	5.9
Texture	6.4	6.7	6.5	6.1	6.1	6.2	6
<b>Average</b>	<b>6.5</b>	<b>6.5</b>	<b>6.0</b>	<b>6.0</b>	<b>6.1</b>	<b>6.1</b>	<b>6.1</b>
Adjectival Rating	Like Moderately	Like Moderately	Like Slightly	Like Slightly	Like Slightly	Like Slightly	Like Slightly

### Breadfruit Pressed Cookies

For the Breadfruit Pressed Cookies, it can be seen that the 40:60 Cake Flour:Breadfruit Flour ratio is more preferred having a rating of 7.5 which is Like Very Much.

Tables 3. Result of Sensory Evaluation for Breadfruit Cookies

Bread fruit Cookies	C1 100% C F	C2 100% B F	C3 60-40 CF- BF	C4 25-75 CF-BF	C5 75-25 CF-BF	C6 50-50 CF-BF	C7 40-60 CF BF
Appearance	7.3	7.2	7.8	7.4	7	7.2	7.5
Flavor	7.2	7.3	7.3	7.8	7.1	6.4	7.4
Texture	7.3	6.5	7.6	7	6.7	6.8	7.1
<b>Average</b>	<b>7.2</b>	<b>7</b>	<b>7.5</b>	<b>7.4</b>	<b>6.9</b>	<b>6.8</b>	<b>7.3</b>
Adjectival Rating	Like very much	Like Moderately	Like Very Much	Like Very Much	Like Moderately	Like Moderately	Like Very Much

### Comparative Acceptability of Breadfruit Baked Products with Existing Products

It can be seen in Table 4 the comparison of the Breadfruit baked products compared with the existing products. It can be gleaned that the result have similar results. The Breadfruit batter cake has an overall mean of 7.2 compared to the existing batter cake, 7.5. The breadfruit pie crust has 6.5 compared to the existing which is 6.3 with an adjectival rating of Like Moderately.

Table 4. Comparative Level of Acceptability of baked products using the Breadfruit (*Artocarpus altilis*) Flour and Existing Product

Treatment	Ave. Weighted Mean			Overall Mean	Descriptive Rating
	Appearance	Taste	Texture		
Breadfruit Batter Cake	7.2	7.5	7.5	7.2	Like Very Much
Existing Batter Cake	7.4	7.4	7.7	7.5	Like very much
Breadfruit Pie Crust	6.6	6.1	6.7	6.5	Like Moderately
Existing Pie Crust	6.6	5.8	6.5	6.3	Like moderately
Breadfruit Pressed Cookies	7.8	7.3	7.6	7.5	Like Very Much
Existing Lengua de Gato	7.3	7.2	7.3	7.2	Like very much

Legend: 8.1 - 9.0 like extremely, 7.2-8.0 like very much ,6.3 – 7.1 like moderately ,5.4- 6.2 like slightly ,4.5- 5.4 neither nor dislike,3.6- 4.6 dislike slightly,2.7 – 3.8 dislike moderately,1.8 2.9 dislike very much,1.0 – 1.7 dislike extremely.

### Cost Benefit Analysis

Costing with the product is important in product development most especially if the product was made for commercialization purpose. In cost analysis, the total cost of the ingredients is multiplied by the mark-up (40%) which will cover the other expenses. Then divided to the total number of yield is equal to selling price. The total selling of the product is less the total expenses are profit.

While the breadfruit Pressed cookies has an average rating of 7.5 which is higher than the existing which is 7.2, however, they have the same adjectival rating of Like Very Much.

Table 4 shows the cost of breadfruit flour incurred in processing the variety of baked product. The butter cake shows the highest cost .and it shows that the cost of breadfruit flour in baked products is least cost

among the ingredient in production of baked product. Pie crust product is the lowest cost among the product but this product cannot be appreciated without the addition of filling so customers will appreciate to buy the product.

Table 5. Cost benefit of Baked Products

Breadfruit Batter Cake	Cost (PhP)	Breadfruit Pressed Cookies	Cost (PhP)	Breadfruit Pie Crust	Cost (PhP)
Cake flour	10.00	Butter	25.00	Lard	20.00
Bread flour	5.00	Sugar	10.00	Breadfruit flour	5.00
Butter	25.00	Egg white	14.00	All purpose flour	7.00
Sugar	20.00	Flour	8.00	Salt	.10
Eggs	14.00	Breadfruit	5.00	Water	1.00
Evaporated Milk	25.00	Vanilla	1.00		
Baking powder	12.00				
<b>TOTAL EXPENSES</b>	<b>111.00</b>		<b>P63.00</b>		<b>P 33.10</b>

Looking deeper into the return of investment of the Butter cake product. The cost of material for butter cake worth of 168 and multiply by the mark up 40 %yield 42 pieces and the total sale of 210 the profit of 42.00 ,The cost of material for cookies worth of 97 yields 8 packs and total cost of 120 less the cost of materials. The profit of 23.00, While the cost of materials for pie crust 37.00, yield of 6 packs and the total cost of 42 less the cost of materials, the profit is 5.00. Among the product produces which has the

lowest cost is the pie crust costing of 33.00 per recipe. But the pie crust cannot be accepted by the customer due to filling. Unlike as the cookies, this product are now ready to eat food. The customer are prepare to buy cookies not the pie crust. The baked product used of breadfruit flour are all accepted by the customer base from flavour, appearance, texture. This result implies that breadfruit flour provide the fastest return of investment this product be made for commercialization.

Table 6: Returned of Investment of breadfruit Batter Cake, Cookies and Pie Crust

Particulars:	Batter cakes	Cookies	Pie crust
Total number of baked product produced	42 pcs@ 5.00/pc	8 packs @15.00/pack	6 packs@7.00/pack
Total sales of Baked Products	210	120	42.00
Production Cost (40%)	155.40	63.00	33.40
Gross margin (60%)	56.60	51.00	9..00
Gross Profit Rate	0.26%	0.42%	0.2%
Return of Investment (ROI)	36%	80%	27%

## CONCLUSION

Breadfruit (*Artocarpus altilis*) is a good source of flour for baked products.

## RECOMMENDATION

It is recommended that nutritional analysis, packaging and shelf-life analysis be done so that this product can be used in extension as an alternative livelihood.

It can be a good material for flour as Production of Breadfruit flour is produced into products for commercialized and can be used as alternative source of material in baking pastries such as cake and cookies. The proportions for pie crust can be improved to meet the acceptability of the consumers.

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