

Development of Bakery Product (Cake) Enriched with Dragon Fruit Pulp

Md. Shah Alam Ratul¹, Md. Jakir Hossain¹, Md Sajjad Hossain¹, SK Fahim Tahmid Boni^{1,*}, Md. Julkor Nayin¹, Tahmid Al Rifat¹

¹*Department of Chemical and Food Process Engineering, Faculty of Mechanical Engineering, Rajshahi University of Engineering and Technology, Rajshahi-6204, Rajshahi, Bangladesh*

Abstract: The demand for fruit-fortified bakery product ingredients is increasing day by day. Developed cake products incorporating Dragon fruit pulp (DFP) significantly increase the nutritional profile and sensory characteristics of the product. This research study aimed to prepare a cake with DFP and compare it with a traditional plain cake. The physical characteristics of the dough show that for the control sample S-1, the dough density is 0.99 gm/cc. But by increasing the percentage of DFP, the dough density is also increased, and hence in the sample S-4 (20% DFP), the density is 1.175 gm/cc. The physical characteristics of the cake also showed different results. The moisture content (MC) decreases with the increased percentage of DFP. The mineral matter content increases with the increased percentage of DFP. The mineral matter content of S-1 (control), S-2 (10% DFP), S-3 (15% DFP), and S-4 (20% DFP) is 4%, 4%, 6%, and 8%, respectively. The sensory analysis results showed that the color, flavor, and texture of the sample containing 15% DFP was better than other cake samples.

Keywords: *Dragon Fruit Pulp (DFP), Sensory analysis, Bakery products, Moisture content (MC), Ash content (AC).*

Introduction: Innovative and healthy food items are in high demand, transforming cuisine. Bakery items are popular because they fulfill our cravings and provide nutrients. The addition of unique and nutritious ingredients to classic dishes has become a fascinating culinary trend. Dragon fruit is a popular exotic fruit owing to its vivid look and health advantages.

Bakeries are among the most consumed meals worldwide. Consumers view cakes as tasty sponge products with desired organoleptic qualities. [1]. The cake is a bread-like confection. Most current versions are sweet baked goods. Disk-shaped cakes were originally composed of fried bread or cheesecake. It might be hard to tell if a product is bread, cake, or pastry. Many modern cakes, especially layer cakes, contain flour, sugar, eggs, butter, or oil, plus milk or water and leavening ingredients such as yeast or baking powder. Cakes are filled with fruit preserves or dessert sauces like pastry cream, coated with buttercream or other icings, and decorated with marzipan, piping borders, or candied fruit [2].

This study investigates dragon fruit pulp's potential as a cake component to create a tasty, healthy baked treat that uses the fruit's inherent deliciousness. This research aims to help establish a new class of bread items by integrating traditional baking methods and the need for healthful enjoyment. Dragon fruit-enriched cakes promise to please the senses with their distinct flavors and health advantages.

The process of making dragon fruit-enriched cakes involves analyzing the fruit's nutritional profile, how it affects cake texture and flavor, customer acceptability, and commercial potential. This interesting culinary journey seeks to alter standard bakery items by using unusual ingredients to provide healthier and more appealing solutions for consumers.

This introduction introduces dragon fruit-enriched baked items and sets the groundwork for research and development. As we learn how to use dragon fruit pulp in cake recipes, we want to create tasty, nutritious, and attractive baked products.

Materials & Method: The experiment on the development of cake with dragon fruit pulp using related ingredients was conducted in the Chemical and Food Analysis Laboratory of the Department of Chemical & Food Process Engineering, Rajshahi University of Engineering & Technology (RUET), Rajshahi, Bangladesh.

Materials: The development process was performed with essential ingredients of cake with dragon fruit from the local market, Shaheb Bazar, Rajshahi, Bangladesh. Dragon Fruit was being sorted manually during the time of purchase from the market. The essential ingredients are wheat Flour (Bashundhara Brand), egg, sugar, salt, baking powder, vanilla essence, milk powder, vegetable oil, and water. Other apparatuses such as the microwave oven, digital balance, beaker, tray, hand mixer, blending machine, paper, and so on were supplied from the laboratory.

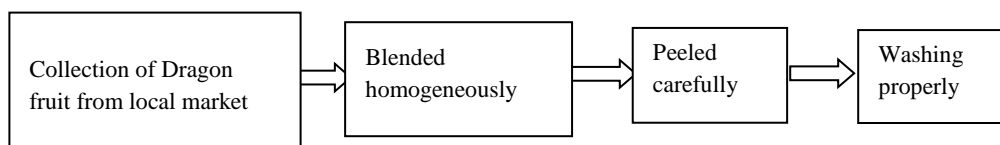
Preparation of Dragon Fruit Pulp: Dragon fruit pulp was brought from the local market and washed carefully, peeled and sliced, and then conducted through the blending machine. The whole procedure of processing dragon fruit pulp for cake is given below:

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Corresponding author details: SK Fahim Tahmid Boni
E-mail address: fahimtahmid111@gmail.com
Tel: +8801690262124

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Preparation of cake: Cakes were prepared by replacing wheat flour and water with different levels of blended Dragon fruit pulp in the basic formulation of cake as per the methods developed before [3]. The wheat flour, blended Dragon fruit pulp, and other ingredients for each cake were weighed properly and the sugar and vegetable oil were mixed in a mixing machine for 20 minutes to produce a cream. After that, oil, egg, and other ingredients and finally the flour were mixed using a hand mixer in two stages variation with time. In the first stage, 40-sec slow mixing and then 120-sec fast mixing, and in the second stage again 40-sec slow mixing and 120-sec fast mixing. The portion of batter, weighing 500 gm in each tray was scaled into pre-greased with vegetable oil in a cake pan. Each of the batches contains 2000 gm separately four cake pans with 500 gm weight. Four batches were conducted in the experiment, each of which contains 2,000gm and were baked in an electric oven for 50 ± 2 minutes at 180 ± 2 °C

Table 1. Formulation of cake with blended Dragon fruit pulp.

Samples Ingredients	S-1(Control)	S-2(10%DFP)	S-3(15%DFP)	S-4(20%DFP)
Wheat Flour(gm)	600	540	480	420
Dragon Fruit Pulp (DFP) (gm)	0	60	90	120
Water(gm)	120	69	43.5	18
Egg(gm)	350	350	350	350
Vanilla Flavor(gm)	4	4	4	4
Sugar(gm)	490	490	490	490
Milk Powder(gm)	20	20	20	20
Baking Powder(gm)	9	9	9	9
Vegetable oil(gm)	400	400	400	400
Salt(gm)	4	4	4	4

*S-1= Control cake (with only wheat flour),

*S-2 = 10% Dragon Fruit Pulp (DFP)

*S-3 = 15% Dragon Fruit Pulp (DFP)

*S-4 = 20% Dragon Fruit Pulp (DFP)

Sensory Evaluation of Cake: The characteristics of the crust and crumb of the cakes supplemented with blended dragon fruit pulp were evaluated and recorded. Cakes were evaluated organoleptically for color, flavor, texture, and overall acceptability. A 1–9-point hedonic rating test was also performed to evaluate the acceptability of cakes containing blended dragon fruit pulp. A set of 15 panelists was selected from teachers & students of the Chemical and Food Process Engineering Department of Rajshahi University of Engineering and Technology (RUET), Rajshahi, Bangladesh. One slice from each batch of the cake was presented to 15 panelists as randomly coded samples. The test panelists were asked to rate the sample for color, flavor, texture & overall acceptability on 1–9-point scale, where 1 = dislike extremely; 2 = dislike very much; 3= dislike moderately; 4=dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7= like moderately; 8 =like very much; 9 = like extremely. [4]

Statistical Analysis: The results were evaluated by one-way analysis of variance (ANOVA) followed by Tukey’s pairwise post-hoc test among the data from the panelists and used to compare the mean values of color, flavor, texture, and overall acceptability.

Results and Discussion: The composition of wheat flour under study was almost similar to [5], who reported the nutrient content of wheat flour as follows: moisture 13.63%, ash 1.15%. The differences in moisture and ash content in the cake were observed variations in this experiment may be due to DFP.

Physical Properties of Dough: The specific volume of dough was 20 ml for each sample and the dough density was measured based on the 20 ml volume. It is a quantitative measurement and correlates well with dough-handling properties, crumb, texture, freshness, and technological versatility [6]. The dough density was increased during the increase of blended DFP concentration in the cake samples.

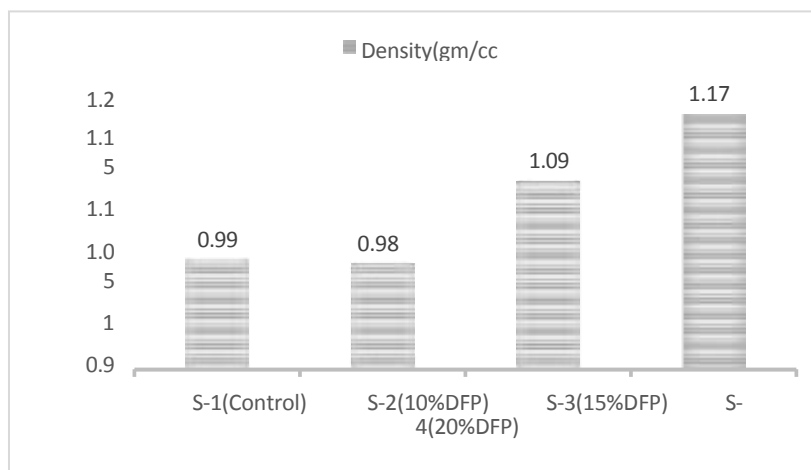


Fig 1. The density of dough for different cake samples.

Crust and Crumb Characteristics: The use of DFP has shown some significant impacts on crust and crumb characteristics. The results are given in table 4.1. The baking also has an impact on physical characteristics and for that, the difference between the control and the composite cakes showed different physical characteristics and put a noticeable change on it.

Table 2. Crust and crumb characteristics of cake.

Sample	Crust Characteristics		Crumb Characteristics				
	color	consistency	color	texture		Odor	Air cell
				Lumps & hardness	Surface		
S-1	Light Brown	Less tender	Yellow	Slightly free	Rough	Appetizing	Airy
S-2	Reddish	Medium tough	Light yellow	Free	Smooth	Sweet	Less airy
S-3	Deep reddish	Medium tough	Light yellow	Free	Light Smooth	Sweet	Close
S-4	Deep reddish	tough	Reddish yellow	Present	Light Rough	Sweeter	Close

From the above discussion, it is clear that the S-3 cake is the best among all cakes.

Chemical Composition of Cake: The change in moisture content of cakes is illustrated in Figure 2. The Moisture content in different cake samples showed variations. The samples S-1 to S-3, the moisture content decreased evenly but in sample S-4, the moisture content increased roughly. Due to the replacement of water and wheat flour with blended DFP and juice which contains water in it. This type of variation occurred due to the imbalanced handling of cake samples after baking.

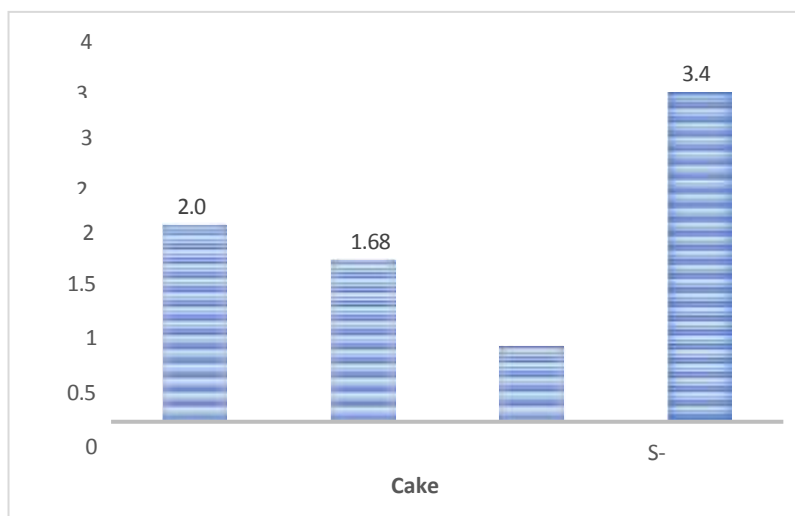


Fig 2. The moisture content of different cake samples.

The ash content of different cake samples increased with increasing the percentage of dragon fruit pulp in the dough. Dragon fruit powder is a rich source of fiber (15.7%). This might be due to the fact that dragon fruit pulp has been used and contains a higher amount of ash. The changes in ash content are illustrated in Figure 3.

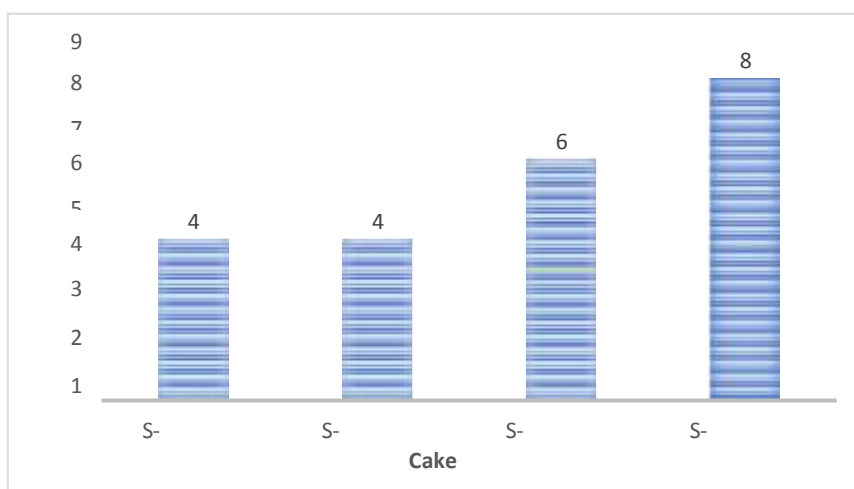


Fig 3. Ash content of different cake samples.

From the above chart, it is clear that with the increase in Dragon fruit pulp, the mineral matter content also increased from 4% to 8%. This is because Dragon fruit pulp has a higher ash content. Previously, biscuits were made from Dragon fruit pulp. It was found that with the increase of dragon fruit powder up to 60 wt% of wheat flour, the mineral content increases by almost 7.81 g% than only with wheat flour.[7]

Sensory Evaluation: The statistically analyzed results of the sensory evaluation are given in Table 2. The results showed the acceptance of using Dragon Fruit Pulp in the cake. The color of cake sample S-3 which contains 15% DFP is more acceptable than the others. The flavor of cake samples S-3 and S-2 are more acceptable than other samples. The texture of cake sample S-3 was also the same as before. The results are shown in Figure 4.

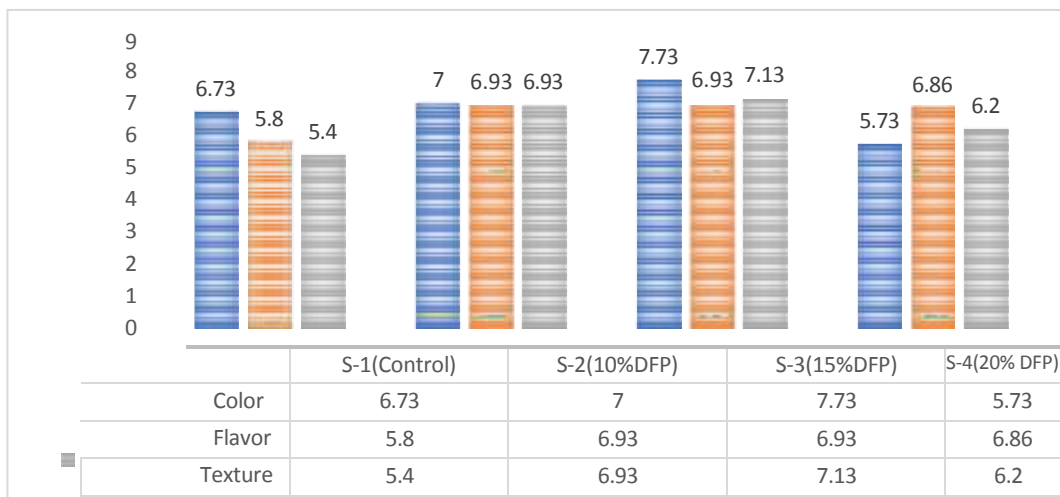


Fig 4. Sensory evaluation of cake.

The Overall acceptability for color, flavor & texture for the Control sample(S-1) is 5.97 ± 0.68 , for Sample 10% DFP is 6.95 ± 0.40 , for Sample 15% DFP is 7.26 ± 0.41 and for Sample 20%DFP is 6.26 ± 0.56 . So, from these data, it is clear that the Cake, which is enriched with 15% DFP is better than the others. The Standard Deviation for Control Sample(S-1), 10% DFP Sample(S-2), 15% DFP Sample(S-3), 20% DFP Sample(S-4) are respectively 0.68, 0.40, 0.41 & 0.56. Figure 5 gives a clearer comparison of the cake samples.

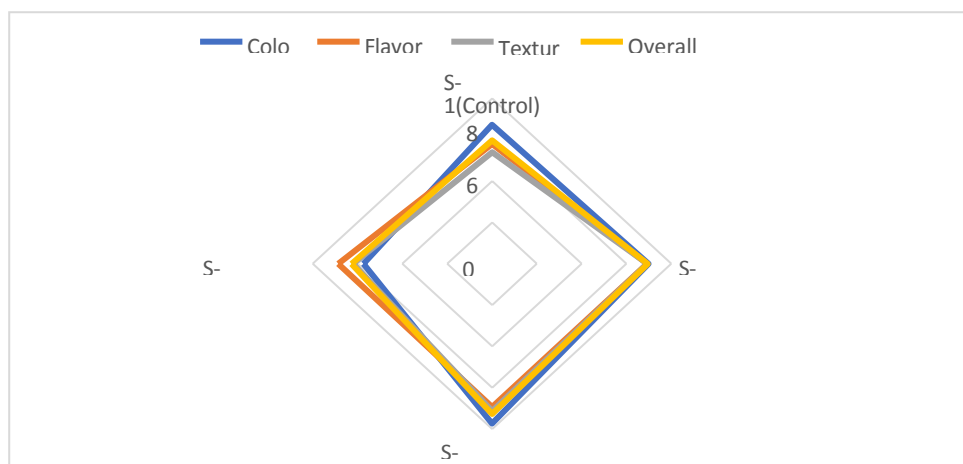


Fig 5. Spider web plot on the sensory attribute of cake samples.

Conclusions: Because a rising number of people across the world are becoming concerned about their health and the nutritional value of various foods, the primary focus of the food processing industry is shifting toward the production of various types of food items that are enhanced with natural color, flavor, and texture. The market for food items that have been nutritionally enhanced is experiencing a very rapid expansion of demand. It is more efficient to produce a replacement product using natural components for an existing product. Based on this body of research, the use of DFP is suggested for the production of cakes as a possible replacement for coloring and/or nutritionally enhanced additives. The color and nutritional characteristics of DFP cake could be subjected to a more in-depth investigation in further research.

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