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Preparation And Evaluation of Fig Fruit Based Cup Cake

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Abstract

The present investigation aimed to study the physicochemical properties and drying characteristics of fig fruit (Ficus carica L.) and to evaluate its potential use in the development of a nutritionally enriched cupcake. Fresh figs were analysed for physical parameters, pH, total soluble solids (TSS), and moisture content. The fruits showed pH values ranging from 5.45 to 5.56, TSS of 10–11 °Bx, and high moisture content of 83.00–84.04%. Tray drying at 60 °C resulted in a continuous reduction in moisture, with the drying process predominantly occurring in the falling-rate period, indicating internal moisture diffusion control. Cupcakes were prepared by incorporating fig pulp at different levels and evaluated using a nine-point hedonic scale. The formulation which contained a balanced proportion of wheat flour (100g) and fig pulp (50g) recorded the highest overall acceptability score (9.0). Proximate analysis of the selected cupcake revealed moisture content of 51.82 g/100 g, protein 5.60 g/100 g, fat 7.42 g/100 g, ash 1.39 g/100 g, total sugars 14.28 g/100 g, calcium 46.78 mg/100 g, and pH 6.27.

The study concludes that fig fruit is suitable effective incorporation into baked products, enhancing both nutritional value and sensory quality.

Keywords: Fig fruit, Tray drying, Cupcake, Sensory Evaluation, Proximate analysis, Value addition

Fig (Ficus carica L.) is a nutritionally valuable fruit recognized for its high content of dietary fiber, natural sugars, minerals, and bioactive compounds such as phenolics and flavonoids. These components contribute to its antioxidant potential and associated health benefits, including improved digestive function and mineral intake. Despite these advantages, figs are underutilized in many regions due to their high moisture content and limited shelf life, which restricts fresh market availability and wider consumption (Hussain et al., 2021).

Drying is an effective preservation technique for high-moisture fruits, as it reduces water activity and enhances storage stability while enabling the development of shelf-stable ingredients. Understanding drying characteristics is essential for optimizing processing conditions and maintaining product quality. Previous studies have shown that hot-air and tray drying methods significantly influence moisture removal behaviour and quality retention in

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fruits, emphasizing the importance of drying kinetics analysis (Norhadi et al., 2020).

In parallel, consumer demand for nutritionally improved bakery products has encouraged the incorporation of fruit-based ingredients into traditional formulations. Baked products such as cakes are widely consumed but are often nutritionally limited. Incorporation of fruit pulps has been reported to enhance fiber, mineral, and antioxidant content while maintaining acceptable sensory properties when used at appropriate levels (Mahmoudi et al., 2018).

However, limited information is available on the combined evaluation of fig fruit drying behaviour and its application in bakery products. Therefore, the present investigation was undertaken to study the physicochemical properties and drying characteristics of fig fruit and to evaluate its suitability as a functional ingredient in cupcake formulation through sensory and proximate analysis.

Material And Methods

Materials

Fresh, fully mature fig fruits (Ficus carica L.) were obtained from the local market and cleaned thoroughly before use. Baking ingredients such as wheat flour, maida, brown sugar, butter, milk, eggs, baking powder, baking soda, and vanilla essence were procured from certified retail sources. All chemicals and reagents used for analysis were of analytical grade.

Physicochemical Analysis of Fig Fruit

Physical Properties

Fruit length, width, and weight were measured using a vernier caliper and electronic weighing balance. Observations were recorded for randomly selected fruits.

pH

Filtered fig juice was analysed using a calibrated digital pH meter at room temperature.

Total Soluble Solids (TSS)

TSS was measured using a hand refractometer and expressed as °Brix after calibration with distilled water.

Moisture Content

Moisture content was determined by oven drying at 105 ± 2 °C until constant weight, following IS 12711:1989.

$$\text{Moisture content (\%)} = \frac{W1-W2}{W1} \times 100$$

Ash Content

Ash content was estimated by incinerating dried samples in a muffle furnace at 550 ± 10 °C, as per IS 12711:1989.

$$\text{Ash content (\%)} = \frac{W3-W1}{W2-W1} \times 100$$

Drying Characteristics of Fig Fruit

Uniform fig slices were dried in a tray dryer at 60 °C. Sample weights were recorded at fixed intervals until constant weight was achieved. Moisture content (wet and dry basis) and drying rate were calculated using standard equations.

$$\text{Wet basis} = \frac{\text{Initial Weight} - \text{Dry Matter}}{Initial\ Weight}$$

$$\text{Dry basis} = \frac{\text{Moisture content on Wet basis}}{100-Initial\ Weight}$$

$$\text{Drying rate (min}^{-1}\text{)} = \frac{\text{M1,(\%DB)}-\text{M2,(\%DB)}}{Time\ difference}$$

Preparation of Fig-Based Cupcake

Fig pulp was extracted and incorporated into cupcake formulations at different levels. Dry ingredients were mixed separately, while sugar, butter, milk, and eggs were whisked to obtain a uniform batter. Both mixtures were combined, poured into Molds, and baked. Three formulations were prepared for further evaluation.

Table 1: Formulation for the preparation of cupcake variants

Ingredients	Treatment I	Treatment II	Treatment I
Wheat (g)	100	75	50
Maida(g)	20	20	20
Fig Pulp (g)	50	75	100
Brown sugar (g)	200	200	200
Milk (ml)	100	100	100
Vanilla essence (ml)	5	5	5
Baking soda (g)	10	10	10
Baking powder (g)	10	10	10
Butter (g)	100	100	100

Sensory Evaluation

Sensory evaluation was conducted using a nine-point hedonic scale to assess colour, appearance, flavour, texture, taste, odour, and overall acceptability by a semi-trained panel.

Proximate Analysis of Cupcake

Moisture and ash determined according to IS 12711:1989, protein estimated by the Kjeldahl method (IS 7219:1973), Crude Fat determined using Soxhlet extraction (IS 12711:1989), Total Sugars estimated by Fehling's method (IS 6287:1985, RA 2020), Calcium determined using wet acid digestion followed by instrumental analysis as per EKA-CHE-SOP-47, and pH measured using a calibrated pH meter

Results And Discussion

Physicochemical Properties of Fig Fruit

The physical characteristics of fresh fig fruits measured prior to drying are presented in Table 2. Fruit height ranged from 49.99 to 54.82 mm, width from 58.12 to 66.21 mm, and weight from 123.48 to 154.80 g. The observed variation reflects natural differences in fruit size and maturity and is consistent with earlier reports on fig varietal diversity.

Table 2: Physical properties of fruit

Sample	Height(mm)	Width(mm)	Weight(mm)
1	54.82	66.21	154.80
2	50.82	58.12	123.94
3	49.99	59.99	123.48

The pH and total soluble solids (TSS) values are summarized in Table 3. The pH of fig samples varied narrowly between 5.45 and 5.56, indicating mild acidity. TSS values ranged from 10.00 to 11.00 °Brix, suggesting uniform sugar content among samples. Such characteristics are favourable for drying and processing, as moderate acidity and soluble solids influence flavour stability and moisture removal.

Table 3: pH and TSS of fig fruit

Sample	pH	TSS(Brix°Bx)
1	5.56	11
2	5.49	10
3	5.45	10

Moisture content of fresh figs, presented in Table 4, ranged from 83.00 to 84.04%. The high moisture level confirms the perishable nature of figs and justifies the need for drying to enhance shelf life and reduce post-harvest losses.

Table 4: Moisture content

Sample	Weight of fruit before drying (g)	Weight of Fruit After drying (g)	Moisture content (%)
1	130.38	20.988	83.00
2	106.21	17.575	83.45
3	1.2.095	16.293	84.04

Drying Characteristics of Fig Fruit

Tray drying at 60 °C resulted in a continuous decrease in moisture content with increasing drying time Graph 1. Moisture content on a dry basis declined rapidly during the initial phase, followed by a gradual reduction and reach constant value at approximately 225 min. This pattern indicates the absence of a constant-rate period.

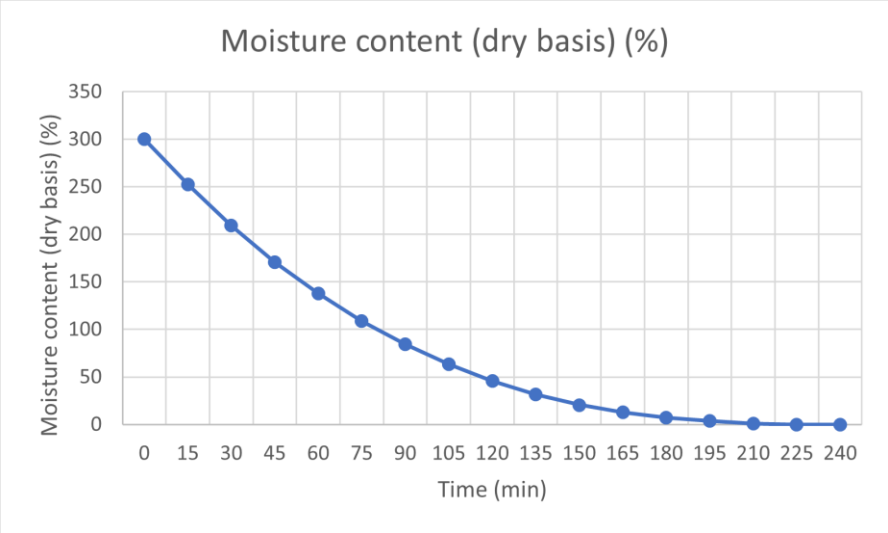
The relationship between drying rate and moisture content is illustrated in Graph 2. Drying rate decreased progressively with declining moisture content, demonstrating a typical falling-rate drying behaviour. This suggests that internal moisture diffusion governed the drying process rather than surface evaporation, a trend commonly observed in high-sugar fruits

Table 5: Drying characteristics of fig fruit by tray drying

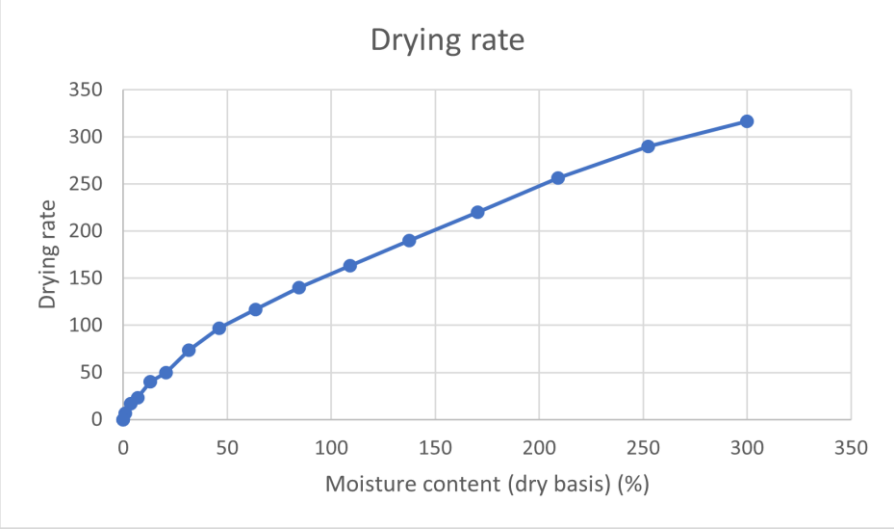
Time	Mass of fig fruit (g)	Moisture content (%)		Drying rate (min^{-1})
		WB	DB	
0	80	75	300	316.66
15	70.5	71.63	252.5	290
30	61.8	67.63	209	256.66
45	54.1	63.03	170.5	220
60	47.5	57.89	137.5	190
75	41.8	52.15	109	163.33
90	36.9	45.79	84.5	140
105	32.7	38.83	63.5	116.66
120	29.3	31.50	46	96.66

135	26.3	23.95	31.5	73.33
150	24.1	17.01	20.5	50
165	22.6	11.50	13	40
180	21.4	6.54	7	23.33
195	20.7	3.38	3.5	16.66
210	20.2	0.99	1	6.66
225	20	0	0	0
240	20	0	0	0

Graph 1: Moisture content vs Time



Graph 2: Drying Rate vs Moisture content



Sensory Evaluation of Fig-Based Cupcakes

Mean sensory scores for the three cupcake formulations are presented in Table 6. Treatment I achieved the highest overall acceptability score (9.00), followed by Treatment II (8.50) and Treatment III (7.50). Statistical comparison of mean scores indicated a clear preference for Treatment I, which contained a balanced proportion of wheat flour and fig pulp. Higher fig pulp incorporation negatively affected texture and taste, likely due to increased moisture and reduced structural strength.

Table 6: Sensory Evaluation

Treatments	Colour	Appearance	Flavour	Texture	Taste	Odour	Overall acceptability
I	9	9	9	9	9	8	9
II	8.08	8	7.8	7.9	8.5	8.1	8.5
III	7.6	8	7.6	7.7	7.5	7.6	7.5

Fig 1: Fig fruit cup cake

Proximate Composition of Selected Cupcake

Based on sensory results, Treatment I was selected for proximate analysis (Table 7). Moisture content was 51.82 g/100 g, contributing to product softness. Protein and fat contents were 5.60 and 7.42 g/100 g, respectively, indicating moderate nutritional enrichment. Total sugars were 14.28 g/100 g, reflecting the natural sweetness of fig pulp. Calcium content (46.78 mg/100 g) highlights the mineral contribution of figs. The pH value of 6.27 indicates near-neutral conditions suitable for baked products.

Table 6: Proximate analysis for Treatment I

Sl. No	Test parameter	Test method	Result	Unit
1	Moisture content	IS 12711: 1989	51.82	g/100g

2	Ash content	IS 12711: 1989	1.39	g/100g
3	Protein	IS 7219: 1973	5.60	g/100g
4	Crude fat	IS 12711: 1989	7.42	g/100g
5	Total sugars	IS 6287: 1985 RA: 2020	14.28	g/100g
6	Calcium	EKA-CHE-SOP-47	46.78	mg/100g
7	pH	pH meter	6.27	

Overall Discussion

The results demonstrate that fig fruit possesses suitable physicochemical properties for drying and food product development. Tray drying effectively reduced moisture through diffusion-controlled mechanisms. Incorporation of fig pulp into cupcakes enhanced nutritional value while maintaining acceptable sensory quality when used at optimized levels. Excessive fig pulp addition, however, adversely affected product acceptability. The findings confirm the feasibility of using fresh fig pulp as a functional ingredient in bakery products.

Conclusion

The study evaluated physico-chemical properties and drying of fig fruit (Ficus carica L.) for nutritionally enriched cupcakes. Fresh figs (height 49.99–54.82 mm, width 58.12–66.21 mm, weight 123.48–154.80 g) have pH 5.45–5.56, TSS 10–11 °Brix, and high moisture (83.45–84.04%), requiring preservation. Tray drying at 60 °C reduced moisture from 75% to 0% in 225 min, showing efficient dehydration. Incorporating fig pulp (100 g wheat flour : 50 g fig pulp) yielded the highest sensory score (9/9) and proximate Composition profile (moisture 51.82%, ash 1.39%, protein 5.60%, fat 7.42%, sugars 14.28%, calcium 46.78 mg/100 g, pH 6.27). Figs are a functional bakery ingredient, enhancing nutrition and consumer acceptability.

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