Nutritional Evaluation and Development of Value-Added Food Products Using Dry Fig Powder (*Ficus Carica*)

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ABSTRACT

The rising incidence of diet-related chronic diseases has highlighted the urgent need for healthier alternatives to refined sugar in food products. Figs (*Ficus carica*), particularly in dried form, are nutrient-dense, fiber-rich fruits with potential applications as natural sweeteners and functional food ingredients. This study aimed to evaluate the sensory acceptability and nutritional contribution of dry fig powder incorporated into commonly consumed food products. Five recipes—ladoo, sweet mathari, granola bar, smoothie, and porridge—were developed in four variations: standard (refined sugar), and samples with 10 g, 20 g, and 30 g fig powder substitution. Sensory evaluation was conducted with 20 semi-trained panelists using a 9-point Hedonic scale, while nutritional values were estimated using the *Nutritive Value of Indian Foods*. Results indicated that products with 20 g fig powder (Sample B) received the highest acceptability scores, ranging from 7.9 to 8.3 across recipes. Nutritional analysis revealed enhanced fiber (up to 9.6 g/100 g), calcium (up to 127 mg/100 g), and potassium (up to 483 mg/100 g) in fig-based products compared with controls. Excessive substitution (30 g) slightly reduced sensory appeal due to darker color and intense flavor. In conclusion, dry fig powder represents a promising natural substitute for refined sugar, improving nutritional quality while maintaining consumer acceptability, with 20 g incorporation found to be optimal.

Keywords: *Ficus carica*, sugar substitute, sensory evaluation, nutritional value, functional foods

INTRODUCTION

Excessive intake of refined sugar has been strongly linked to obesity, type 2 diabetes, cardiovascular diseases, and other chronic metabolic disorders. As public health policies increasingly advocate reduced sugar consumption, there is a growing demand for natural alternatives that provide sweetness while contributing additional nutrients and health benefits.

Figs (*Ficus carica*), belonging to the Moraceae family, are one of the earliest domesticated fruits, historically cultivated in the Mediterranean, Middle East, and South Asia. In India, cultivation is concentrated in Maharashtra, Gujarat, Karnataka, Uttar Pradesh, and Tamil Nadu. Fresh figs are seasonal, while dried figs are widely available throughout the year and valued for their longer shelf life.

Nutritionally, dried figs are rich in dietary fiber, calcium, potassium, magnesium, and phenolic compounds. Their antioxidant and hypocholesterolemic properties have been documented in several studies (Chauhan et al., 2011; Arvaniti & Samaras, 2019). The high fiber content aids digestion, while potassium contributes to glycemic regulation and cardiovascular health. Figs also offer potential as a sugar replacer, given their natural sweetness and binding capacity when powdered.

Despite their nutritional promise, limited research has examined the application of fig powder in traditional Indian recipes. The present study was therefore undertaken to:

1. Develop value-added food products using dry fig powder as a substitute for refined sugar.
2. Assess organoleptic (sensory) characteristics of the developed food products.

3. Estimate the nutritive value of these products.

The central hypothesis was that incorporation of dry fig powder would improve nutritional quality while maintaining consumer acceptability.

MATERIALS AND METHODS

Processing of Dry Fig Powder

Fresh figs were procured from Durga Orchards, Manali (Himachal Pradesh, India). Fruits were halved and sun-dried for 2–3 days, followed by oven-drying at 65 °C for 2 minutes to reduce residual moisture. The dried figs were then ground into fine powder using an electric grinder and stored in airtight containers for subsequent use.

Product Development

Five food products-ladoo, sweet mathari, granola bar, smoothie, and porridge—were selected for development due to their popularity and ease of modification. Each product was standardized and prepared in four variations:

- **Standard (control):** Refined sugar as sweetener
- **Sample A:** 10 g fig powder substitution
- **Sample B:** 20 g fig powder substitution
- **Sample C:** 30 g fig powder substitution

Recipes incorporated common base ingredients (wheat flour, gram flour, nuts, milk, and oats) with fig powder replacing sugar either partially or fully.

Sensory Evaluation

Sensory quality was assessed by a panel of 20 semi-trained judges, primarily postgraduate students in nutrition. Products were evaluated for appearance, color, texture, flavor, taste, and overall acceptability using a 9-point Hedonic scale (1 = dislike extremely; 9 = like extremely). Samples were coded and presented in random order to avoid bias.

Nutritional Evaluation

Nutrient values were calculated using the *Nutritive Value of Indian Foods* (Gopalan et al., 2017). Key parameters included energy, protein, carbohydrates, fat, fiber, calcium, and potassium.

Statistical Analysis

Data were expressed as mean ± standard deviation (SD). Differences across product variations were compared descriptively, focusing on trends in acceptability and nutrient enhancement.

Results

Sensory Evaluation

Across all five products, substitution with 20 g fig powder (Sample B) yielded the highest acceptability scores.

- **Ladoo:** Sample B scored 8.1 ± 0.67, significantly higher than Sample A (7.5 ± 0.50) and Sample C (7.3 ± 0.68).
- **Sweet Mathari:** Sample B achieved 8.1 ± 0.71 compared with 7.5 ± 0.76 for Sample A.
- **Granola Bar:** Acceptability peaked at 7.9 ± 0.62 in Sample B.
- **Smoothie:** Highest rating at 8.3 ± 0.65 for Sample B.

- **Porridge:** Sample B scored 8.2 ± 0.61, outperforming other variations.

Panelists reported that higher substitution (30 g) imparted an overly dark color and stronger fig flavor, which slightly reduced sensory appeal. Standard (refined sugar) versions were acceptable but lacked the unique flavor contribution of figs.

Nutritional Analysis

Nutritional composition improved consistently with fig powder incorporation.

- **Energy:** Ranged from 181 kcal (porridge with fig) to 507 kcal (ladoo with refined sugar).
- **Protein:** Highest in granola bar (12.8 g/100 g, Sample A).
- **Carbohydrates:** Between 27–66 g depending on recipe.
- **Fat:** 6–22 g, largely from nuts and ghee.
- **Fiber:** Increased notably in fig-based products, up to 9.6 g in sweet mathari (Sample A).
- **Calcium:** Up to 127 mg/100 g in porridge with fig substitution (Sample C).
- **Potassium:** Substantial improvement, up to 483 mg/100 g in ladoo (Sample B).

Thus, fig-based products delivered higher fiber and mineral content compared with refined sugar versions, aligning with the health-promoting potential of *Ficus carica*.

DISCUSSION

This study demonstrated that dry fig powder can successfully substitute refined sugar in both traditional (ladoo, mathari) and modern (granola bar, smoothie) recipes without compromising consumer acceptability.

The finding that 20 g substitution (Sample B) yielded optimal scores suggests that moderate incorporation balances sweetness, flavor, and appearance. Excessive substitution (30 g) was less favored due to sensory alterations, consistent with earlier reports that intense fig flavor may not appeal to all consumers (Medhe et al., 2019).

Nutritionally, fig incorporation enhanced dietary fiber, calcium, and potassium—nutrients often lacking in modern diets. Fiber contributes to satiety and gastrointestinal health, while calcium supports bone health and potassium aids in blood pressure regulation. Previous studies have similarly reported the hypocholesterolemic and antioxidant benefits of dried figs (Chauhan et al., 2011; Canal et al., 2015; Madani et al., 2019).

From a public health perspective, replacing refined sugar with fig powder offers a “dual benefit”: reducing empty calorie intake while providing functional nutrients. This aligns with global recommendations for sugar reduction and increased fruit consumption.

Nevertheless, the study was limited by its small sample size and reliance on calculated rather than laboratory-analyzed nutrient values. Future work should include chemical analysis, glycemic index testing, and larger consumer studies to validate acceptability across diverse populations. Shelf-life studies are also warranted for commercial application.

CONCLUSION

Dry fig powder is a feasible, nutrient-rich substitute for refined sugar in commonly consumed foods. Incorporation at 20 g per 100 g product provided the best balance of sensory acceptability and nutritional enhancement. Such fig-based products hold promise for health-conscious consumers and could be developed into diabetic-friendly or functional food ranges.

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