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Development and formulation of peach pulp incorporated fudge

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Abstract

This study focuses on the formulation, standardization, and evaluation of Peach Pulp Incorporated Fudge (PPIF), a fruit-based confectionery product enriched with dark chocolate and peach pulp. Peaches are a rich source of vitamins A and C, fiber, and antioxidants, while dark chocolate provides flavonoids with potential health benefits. The objectives of this study included developing a unique fruit fudge recipe, optimizing natural sweeteners and preservatives, and assessing sensory attributes and consumer acceptability.

The methodology involved screening ingredients, standardizing formulations, and evaluating nutrient composition, sensory attributes, packaging, and shelf life. Two variations (PPIF 1 and PPIF 2) were tested, with PPIF 2 receiving higher sensory scores for taste, texture, and overall acceptability. Nutrient analysis indicated that PPIF 2 contained 550.2 kcal, 9.5g protein, 46.43g fat, and 6.7mg iron per 100g, making it a nutrient-dense product. The study also included cost analysis, revealing that the developed fudge is more affordable than similar commercial products.

The results highlight PPIF 2 as a highly acceptable and nutritious dessert, offering a healthier alternative to conventional chocolate-based sweets. Future studies can explore extended shelf-life techniques, alternative ingredient variations, and large-scale commercialization.

Keywords: Peach pulp; Fruit fudge; Dark chocolate; Nutrient analysis; Sensory evaluation; Shelf life study

1. Introduction

Peach (*Prunus persica*) is a deciduous fruit-bearing tree belonging to the Rosaceae family [1]. Native to Northwest China, it is widely cultivated in temperate regions across the world. The name "peach" is derived from the Latin word "persica," meaning "Persian apple," as it was once believed to have originated from Persia. China, Italy, Spain, Greece, and the United States are among the top producers of peaches globally [2]. The fruit consists of approximately 88% pulp, 6% seed, and 6% skin. Peach is a nutrient-rich fruit containing vitamins, minerals, and antioxidants essential for human health. It is a good source of dietary fiber, carbohydrates, and vitamins such as vitamin C, vitamin A, and vitamin E [3]. The fruit is a rich source of essential minerals, including potassium, magnesium, calcium, and iron. Peaches are rich in natural sugars, including sucrose and fructose, which provide quick energy and aid digestion [4].

Dark chocolate is derived from Theobroma cacao L., a tropical tree cultivated primarily in West Africa, South America, and parts of Asia. The cocoa beans harvested from Theobroma cacao are fermented, dried, roasted, and processed to produce cocoa solids and cocoa butter, the primary components of dark chocolate. Unlike milk chocolate, dark chocolate has minimal to no milk content and contains a high percentage of cocoa solids, making it a healthier choice.

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Dark chocolate is rich in bioactive compounds, including flavonoids, polyphenols, and theobromine, which contribute to its antioxidant properties. It is also a good source of essential minerals such as iron, magnesium, potassium, phosphorus, zinc, and calcium. Additionally, dark chocolate contains moderate amounts of fiber and healthy fats, primarily oleic acid, stearic acid, and palmitic acid. The sugar content in dark chocolate is lower than in milk or white chocolate, making it a preferred option for health-conscious consumers [5].

2. Material and methods

2.1. Collection of Raw Ingredients

Raw materials, including peach pulp, dark chocolate, milk, condensed milk, and unsalted butter, were procured from a local grocery market in Madurai, Tamil Nadu.

2.2. Formulation of Peach Pulp Incorporated Fudge

The study was conducted at the Food Analytical Laboratory, Department of Food Science and Processing Management, Subbalakshmi Lakshmipathy College of Science, Madurai.

2.2.1. Peach Processing

Wash and clean the peaches, dark chocolate, and other required ingredients. Blanch the peaches for 5 minutes. Subsequently, peel off the skin and remove the seeds.

2.2.2. Peach Pulp Preparation

Mash the pulp and cook it with sugar in a pan until the mixture thickens. Allow the mixture to cool completely.

2.2.3. Dark Chocolate Mixture Preparation

Melt the dark chocolate and butter over a double boiler. Incorporate milk and condensed milk into the chocolate mixture to mellow its bitterness.

2.2.4. Layering and Setting

Pour and layer the blended mixture of peach pulp and chocolate into a silicone mould. Let the fudge set by refrigerating or keeping it at room temperature for 2 to 3 hours.

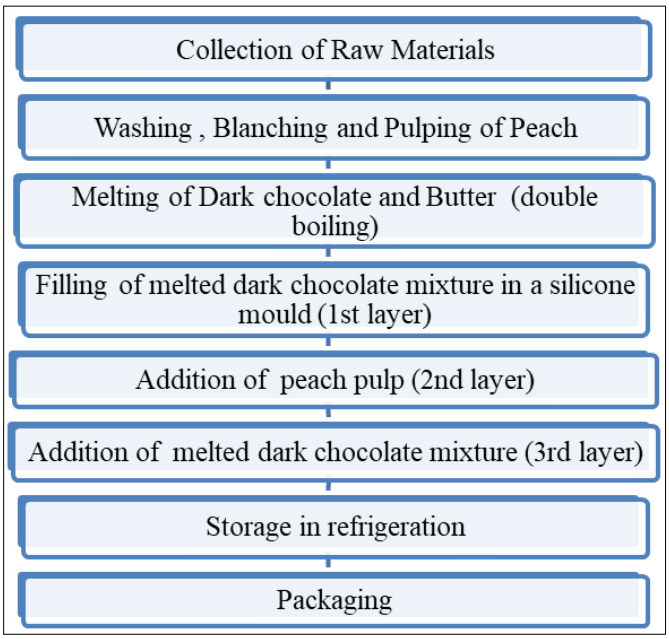

Figure 1 Formulation of peach pulp incorporated fudge

2.3. Variations of Peach Pulp Incorporated Fudge

Peach pulp-incorporated fudge has high nutritional value and enormous health benefits. The prepared product is made into two variations.

- PPIF 1 – Peach pulp and dark chocolate incorporated in the ratio of 5:60
- PPIF 2 – Peach pulp and dark chocolate incorporated in the ratio of 7:60
- PPIF - Peach Pulp Incorporated Fudge

2.4. Development of Peach Pulp Incorporated Fudge

The proportion of ingredients used to prepare Peach Pulp Incorporated Fudge and its variations are given in Table No. 1.

Table 1 Variations of Peach Pulp Incorporated Fudge

S.No	Ingredients	PPIF 1	PPIF 2
1	Peach pulp	5g	7g
2	Dark chocolate	60g	60g
3	Milk	10 ml	10 ml
4	Condensed milk	5g	3g
5	Unsalted butter	20g	20g

2.5. Sensory Evaluation

A sensory evaluation was conducted to assess the acceptability of the developed Peach Pulp incorporated Fudge. The sensory evaluation was conducted using a 5-point hedonic scale with eighteen semi-trained panelists rating attributes such as color, taste, texture, and appearance. The nutritional analysis confirmed the product's high energy, protein, and fiber content. The developed product, with its two variations, was coded as PPIF 1 and PPIF 2. The scores from the 18 semi-trained panelists were then averaged to determine the mean value [6].

2.6. Nutrient Estimation

The nutrient content of the Peach Pulp Incorporated Fudge (PPIF) was calculated using the values of peach and dark chocolate from the Indian Food Composition Tables, NIN - 2017 and Nutritive value of Indian Foods, NIN – 2007[7].

2.7. Packaging and Labelling

Packaging was used to store and sell the product. Packaging material protects the product from microbial, chemical, and physical damage, ensuring safe storage and sale. Food labelling provides essential information on ingredients, nutrition, and storage guidelines, ensuring compliance with regulations. The product label includes key details such as product name, ingredient list, nutrition facts, manufacturer information, expiration date, and handling instructions. Proper food labelling enhances consumer awareness, food safety, regulatory compliance, and brand trust.

3. Results and discussion

3.1. Sensory Evaluation

The mean scores for sensory of PPIF 1 and PPIF 2 samples are shown in Table 1.

Among the developed products, the overall mean score in PPIF 2 was highly acceptable. The result revealed that PPIF 2 secured the highest score, and the sensory attributes of this sample got more preference than other developed products.

Overall, the mean score of the sensory evaluation is depicted in Table 2

Table 2 The mean scores for sensory of PPIF 1 and PPIF 2 samples

Sensory Attributes	Colour	Taste	Texture	Appearance	Overall Acceptability
Sample A (PPIF 1)	5	4	3	4	3.75
Sample B (PPIF 2)	5	5	4	5	4.75

* PPIF - Peach Pulp Incorporated Fudge

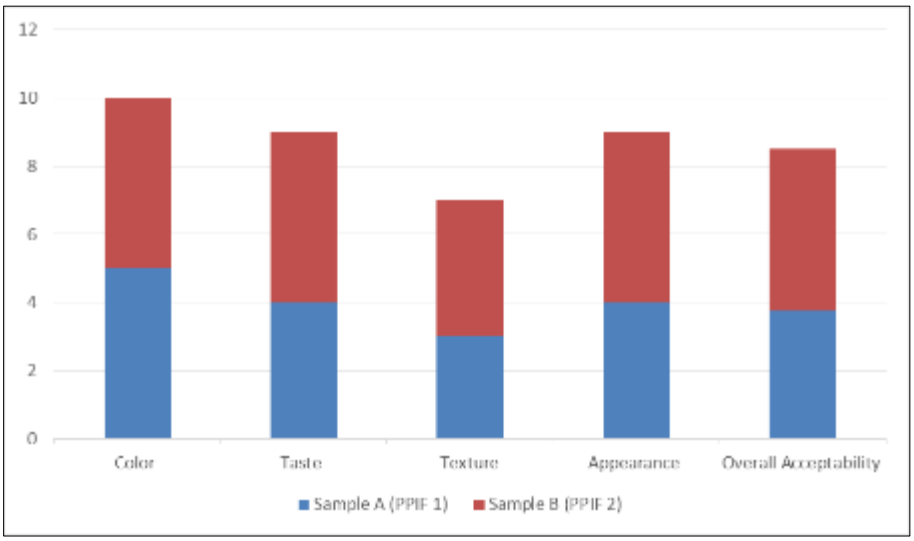

Figure 2 Overall Mean Score

3.2. Nutrient Estimation

The results of the nutrient estimation are depicted in Table 3

Table 3 Results of Nutrient Estimation

Nutrients	Nutritive value
Energy (kcal)	550.2
Protein (g)	9.5
Fat (g)	46.43
Minerals (g)	0.14
Fibre (g)	12.08
Carbohydrates (g)	50.18

Note: The above values are derived from standard nutritive values of the ingredients used in the formulation and are not obtained through direct laboratory estimation [7].

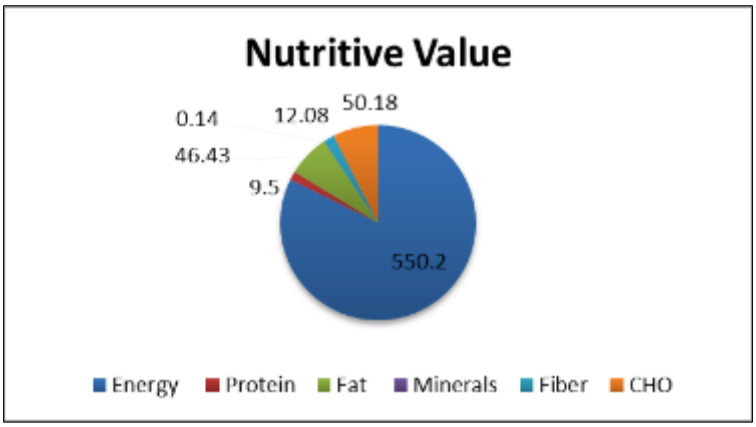

Figure 3 Nutritive value of the developed fudge

3.3. Packaging and Labelling

The Peach Pulp Incorporated Fudge (PPIF) is packaged using corrugated cardboard with an inner wax coating to extend shelf life and maintain product quality. The standardized PPIF 2 sample is packed in this material to ensure freshness. This sample label is designed following FSSAI regulations for clear product identification [8].

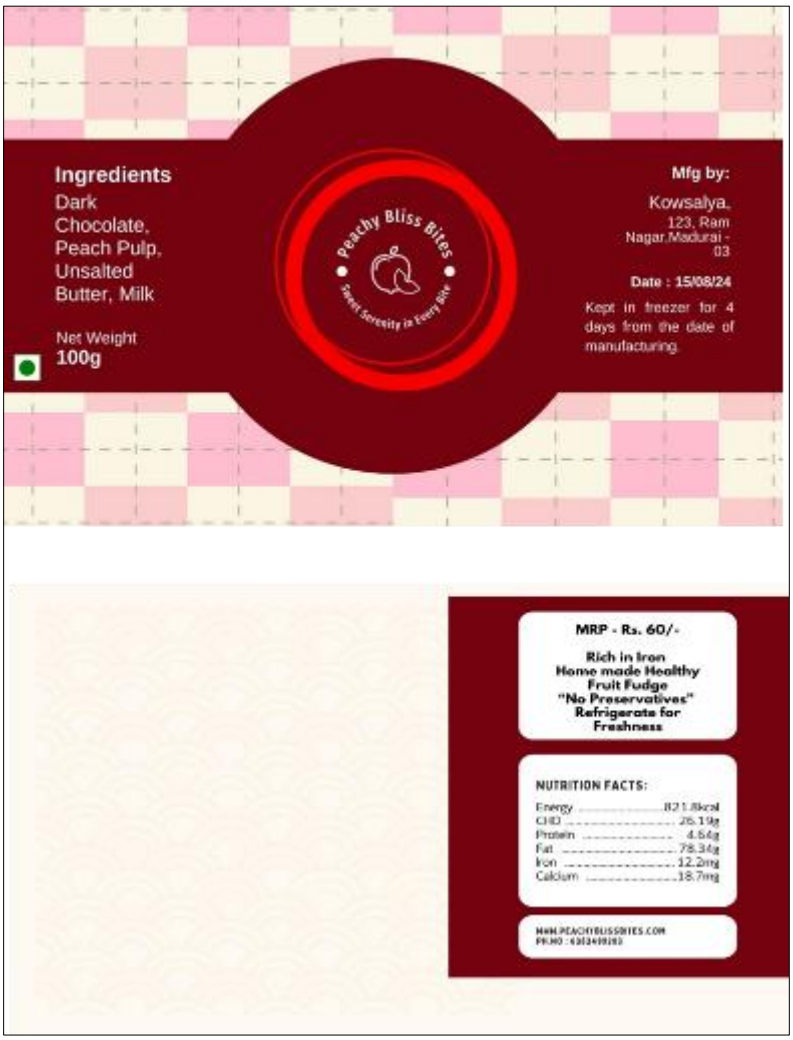

Figure 4 The front and back part of the label

4. Conclusion

The peach pulp incorporated fudge developed in this study proved to be a nutritious, cost-effective, and highly acceptable product. The sensory evaluation confirmed its consumer appeal and nutritional analysis highlighted its high energy and fiber content. This product has potential for commercialization in the confectionery industry.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest currently.

Statement of ethical approval

The authors affirm that the research presented in this manuscript does not involve the use of human or animal subjects.

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