



Formulation of Cake with Banana Peel Extracts to Enhance Colour and Bioactive Properties

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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Short Research Article

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ABSTRACT

Aim: To analyse the phytochemical and nutrient content of banana peel extract and incorporate in cake to enhance the bioactive properties.

Study Design: An experimental design is used as it is used mostly in formulating product, process development, sensory testing, and analysis.

Place and Duration of the Study: Department of Clinical Nutrition and Dietetics, PSG College of Arts & Science and Alpha labs technologies, Coimbatore between June 2019 and November 2020.

Methodology: Cake was chosen as a product to develop with incorporation of banana peel extract. Nutrient analysis and sensory evaluation was done for the control and sample product. Banana peel extract was obtained by filtration using muslin cloth and processed. Various phytochemical tests were performed and found that alkaloids, terpenoids, saponins, proteins and steroids were present in the peel extract.

Results: Phytochemicals like alkaloids, terpenoids, saponins, proteins and steroids were identified in both small and big banana. Small banana peels contain more amount of calcium, potassium, and sodium compared to big banana. DPPH values obtained as 0.22. Total antioxidant properties of banana peel were calculated and the value obtained as 0.215. The carbohydrate and fibre content of the cake incorporated with banana peel extract was higher than control product further shelf life is also enhanced.

Conclusion: Banana peel extract is a good source of natural food colour as black with positive effect on nutrients. As functional food ingredient, banana peel extract promote human health and also extend the shelf life of the products as it is an antioxidant and antimicrobial natural sources.

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1. INTRODUCTION

'The first to feast is the eyes' is an ancient adage with very substantial meaning and describes how colours in food have importance. Perception is usually prejudiced by the appearance of the food and this stipulates the fragrance. It is significant to reminisce that the colour of a food or beverage often rules over other sources of information concerning about the flavor. Colour is an important factor for consumer acceptance in food products. Several studies states that the colour of a food or beverage plays an intense role in savour perception create a passion towards food.

Consumers are subtle to food colour as it gives evidence on freshness, safety and sensory characteristics. Since there are growing concerns about synthetic colourants many consumers prefer for natural colourants. Regrettably, several natural colourants are not constant in their applications in food products, as they are heat sensitive. Hence the dyeing industry is incessantly considering for underutilized pigmented plants as novel sources of sturdy colourants. For food colorings, in West Africa the mature leaf sheaths harvested from sorghum plants are used as dye after processing. The red pigment extracted from dye sorghum leaf sheaths is rich source of 3-deoxyanthocyanidins, which is a rare group of natural pigments. Yellow banana peels are good sources of flavonoids and phenolic with carbohydrates, cellulose, and also minerals like potassium and sodium. The phytochemistry and pharmacology study on banana were reviewed and reported that the banana pulp and peel are used for the development of drugs and also as functional foods [1]. Phenolic compounds in banana peels are found to have effective antioxidant and antimicrobial activities, and associated with numerous health benefits [2].

Around six commercial banana cultivars like Grand Naine, Ney Poovan, Poovan, Karpuravalli, Red Banana and Virupakshi were used to estimate the anthocyanin content, antimicrobial properties and their suitability as food colourant in various studies. Anthocyanin, phenolic and flavonoid contents are found to be high in red banana [3]. The anthocyanin extract from banana peel shows antimicrobial activity against bacteria and fungi [4].

Cake is one of the favorite and naturally baked sweet dessert. Cakes are the different variations of breads, however at present cakes cover a wide range of preparations that can be simple or elaborate, which share the features with other dessert courses like pastries, meringues, custards and pies. Common cake constituents are flour, sugar, eggs, butter or oil or margarine, a liquid, and baking powder as leavening agent. The usual added ingredients and flavourings include dried, candied, or fresh fruit, nuts, cocoa, and extracts such as vanilla, strawberry, pistachio, and other fruits [5].

In USA, the proximate principles of banana peels were estimated as 9.4% protein, 6.7% fat and 11.5% fiber while the Indian variety of banana peel reported 11.7%, 3.6% and 14.4% for protein, fat and fiber respectively. A significant amount of total phenols, flavonoids and tannins are found in all varieties of banana peel. These peels are incorporated as value added foods which aid as a functional food. For instance the banana peel powder at 5 % level of incorporation in extruded product pasta was formulated. The banana peel powder incorporation reported nutritional composition enhancement and the colour and texture profile were not significantly affected [6].

Some of the artificial food colours used for long term are believed to be carcinogenic and few colours, like red, orange have been banned from food use. To adhere natural food colour with nutritional enhancement was the aim, hence, the present study was framed with the objectives as to analyse the phytochemical and nutrient content of banana peel extract, to formulate the cake with banana peel extract and to undergo sensory evaluation and nutrient analysis in the formulated cake.

2. MATERIALS AND METHODS

2.1 Preparation and Analysis of Banana Peel Extract

The small poovan banana (*Musa acuminata* × *balbisiana*) and Big Morris - Cavendish banana (*Musa acuminata* cavendish subgroup) were purchased from the local market of Coimbatore. The criteria for purchasing samples were to be fresh, rippen, and dust free. Nearly 5gm of banana peel was taken and dipped in 20ml of distilled water for 30 minutes. It was then

crushed using mortar and pestle. Peel extract was filtered using muslin cloth. Phytochemical test for Alkaloids, Terpenoids, Phenol, Sugar, Saponins, Flavonoids, Quinines, Proteins and Tannins were done. Moisture, ash, protein, carbohydrate, sodium, calcium, potassium and fibre were also analyzed by AOAC method [7].

2.2 Formulation of Cake with Banana Peel Extract

Control sample was the a normal cake prepared without banana peel extract incorporation and the cakes containing small banana peel extract 10% as variation 1(v1) and 20% as variation(v2) were also made with the same mode of preparation.

2.3 Sensory, Nutrient and Shelf Life Analysis of Formulated Cake

Organoleptic evaluation of cake was assessed by 25 semi trained panel members by using score card with 5 point hedonic scale. Semi trained panel members judged quality of the product for various parameters like appearance, colour, flavour, texture, taste and over all acceptability from the variations (v1, v2,)with the control. The variation v1 was selected through organoleptic evaluation as it received higher

acceptability score than other variation was used for study of nutrient analysis and shelf life of the product. Nutrition analysis refers to the process of determining the nutritional content of foods and food products. Various nutritional analyses like protein, carbohydrate, moisture, ash, sodium, potassium and calcium were performed. To determine the antioxidant activity DPPH assay was used. To determine the product quality in case of storage conditions, the shelf life was analyzed for the developed product by turbidity test a widely used method to determine the number of microbial growth in the samples. In this study to identify the turbidity in the sample a UV-Visible spectrophotometer in transmission mode was used and the absorption of the samples was measured at 390 nm.

3. RESULTS AND DISCUSSION

3.1 Phytochemical Analysis of Banana Peel Extract

Phytochemicals under research studies are classified into major categories, such as carotenoids and polyphenols, which include phenolic acids, flavonoids, and stilbenes/lignans. Various phytochemical tests were performed and the results obtained are presented in Table 1.

Table 1. Formulation of cake incorporated with banana peel extract

Ingredient	Control	Variation 1	Variation 2
Flour	100	90	100
Banana peel extract	0	10	20
Common ingredients	85g Sugar, 85ml Oil, 3.5g Baking powder and 100g Egg		

Table 2. Phytochemical analysis of banana peel extracts (100g)

Test	Musa balbisiana (Small banana)	Musa acuminata (Big banana)
Alkaloids	Present	Present
Terpenoids	Present	Present
Phenol	Absent	Absent
Sugar	Absent	Absent
Saponins	Present	Present
Flavanoids	Absent	Absent
Quinines	Absent	Absent
Proteins	Present	Present
Steroids	Present	Present
Tannins	Absent	Absent

The test results showed that phytochemicals like alkaloids, terpenoids, saponins, proteins and steroids are present in both small and big banana. The other phytochemicals like phenol, sugar, flavonoids, quinones and tannins are found to be absent.

3.2 Nutrient Analysis of Banana Peel Extract

Banana peel holds bioactive compounds like phlobatannins, tannins, flavonoids, alkaloids, glycosides, terpenoids, and anthocyanins, which are precisely known for their biological and pharmacological aspects such as antibacterial, antidiabetic, antihypertensive, and anti-inflammatory characteristics [8,9].

Banana peel contains high amount of fibre, protein, magnesium, potassium, vitamin B6 and B12. Banana peels are consumed by people worldwide though it is not a common food and tastes sweet as banana. The following table -2 shows the nutrient analysis of banana peel extract.

By referring the above table with the values obtained from the nutrient analysis it was clear that small banana peel contains more amount of calcium, potassium, and sodium compared to big banana. Moisture and ash content was same for both samples.

3.3 DPPH Assay and Total Antioxidant of Banana Peel Extract

DPPH assay is a preliminary test to investigate the antioxidant potential of extracts. DPPH values obtained as 0.182 and 0.22 respectively for small banana and big banana. The antioxidant activity of banana peel was determined by DPPH assay. This assay has been widely used to test the free radical scavenging ability of various samples. The total antioxidant values obtained for the developed product were 0.137 and 0.215 for small banana and big banana respectively. Similar results earlier reported the relationship of free radical scavenging potential of bananas, different extracts and their chemical screening [10].

Table 3. Nutrient analysis of banana peel (100g)

Nutrient	Musa balbisiana (Small banana)	Musa acuminata (Big banana)
Protein(g)	1.3	2.2
Carbohydrate(g)	2.1	2.5
Sodium($\mu\text{g/g}$)	223	115
Calcium($\mu\text{g/g}$)	255	163
Potassium($\mu\text{g/g}$)	234	123
Moisture	9%	9%
Ash	11%	11%
Fibre	62.8	65.2



plate I Control product (cake)

plate II Variation - 1

plate III Variation -2

Fig. 1. Developed food products

3.4 Product Development

Banana peel based sauce was formulation comprising of banana peel, coriander leaves, garlic, vinegar, red chilly and spice. Ready to cook curry mix comprised of banana peel, crushed red chilly, garlic, cumin, turmeric powder and curry leaves as well as soup mix with banana peel powder was also formulated [11]. In present study cake was developed with incorporated small banana peel extract as it contain more amount of calcium, potassium, and sodium compared to big banana. Nutrient analysis and sensory evaluation was done for the control and test sample products. The below figure shows that the plate I was control product, plate II and III was the test sample variation 1 and 2 respectively. The colour difference was identified in plate II and III as dark brown compared with control in plate I is due to the amalgamation of banana peel extract (enzymatic browning) in the prepared cakes.

3.5 Sensory Analysis

Below table represents the organoleptic properties of sample compared with standard. From the data obtained it was observed that variation I have the highest overall acceptability compared with variation II and control product.

Data represented as mean \pm standard deviation. *Significantly different ($p < 0.05$) from each other
Organoleptic evaluation of cake was assessed by 25 semi trained panel members by using

score card with 5 point hedonic scale. Semi trained panel members judged quality of the product for various parameters like appearance, colour, flavour, texture, taste and over all acceptability. From the variations I and II; variation I was selected through organoleptic evaluation and it received higher acceptability score than other variations and it was used to analyze the nutrients and shelf life. The color, flavor, texture and overall acceptability of the developed cakes were altered due to the amalgamation of banana peel extract [12].

3.6 Nutrient Analysis

Peels of fruits and vegetables are the most vital part not only helps to protect the body from deficiencies and diseases and also it clears out the free radicals, by the presence of phenols which are antioxidant in addition with vitamins and minerals. Researches have proved the presence of vitamin C, E, B6 in banana peels.

From the above table it was clear that the carbohydrate and fibre in nutrient analysis of sample incorporated with banana peel was higher than control product. It was found that protein, sodium, calcium, potassium, and moisture were more or same. In a study it was concluded that the incorporation of banana peel powder to chicken sausage changed its properties and remained as a potential candidate as a value-adding ingredient which can be used during meat preparation as it positively influences the nutritional value and specific technological properties of the food [13].

Table 4. Mean organoleptic score for cake

Sensory characteristics	Control	Variation 1	Variation 2
Appearance	4.5 \pm 0.5*	4.7 \pm 0.5*	4.2 \pm 0.4
Colour	4.3 \pm 0.4*	4.8 \pm 0.5*	4.3 \pm 0.5*
Flavor	4.6 \pm 0.5	4.5 \pm 0.5*	3.5 \pm 0.5*
Texture	4.0 \pm 0.5*	4.7 \pm 0.5	3.1 \pm 0.4*
Overall acceptability	4.4 \pm 0.3*	4.8 \pm 0.5*	3.0 \pm 0.5*

Table 5. Nutrient analysis of control and sample

Nutrient	Control product (100g)	Sample incorporated with 10% banana peel extract (100g)
Protein (g)	4.12	4.18
Carbohydrate (g)	61.96	67.2
Sodium (mg)	4.5	4.9
Calcium (g)	1.02	1.2
Potassium (g)	2.3	2.7
Fiber (g)	Nil	6.68
Moisture (%)	0.09	0.09

Table 6. Shelf life evaluation of variation 1

Variation	Presence of Turbidity			OD Value (600nm)		
	0 th day	5 th day	10 th day	0 th day	5 th day	10 th day
Control	absence of turbidity	Presence of turbidity	Presence of turbidity	0.05	0.086	0.162
Variation - I	Absence of turbidity	Absence of turbidity	presence of turbidity	–	–	0.08
Variation - II	Absence of turbidity	Absence of turbidity	presence of turbidity	0.02	0.023	0.093

3.7 Shelf Life Evaluation

Shelf-life is the consumer's guide of the period of time that food can be kept before it starts to deteriorate, provided any stated storage conditions have been followed. The determination of shelf-life is therefore the length of time a product may be stored without becoming unsuitable for use or human consumption, and is the responsibility of the manufacturer. Banana peel extract have antimicrobial activity against numerous microorganisms such as *Staphylococcus aureus*, *Streptococcus pyogenes*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Escherichia coli*, *Moraxella catarrhalis* and *Candida albicans*. Colour retention, enhanced flavor and texture was found in samples with banana peel extract of 80% ethanol treatment and reported that the banana peel can be used as a potential source to extend shelf stability [14]. The below table shows the shelf life evaluation analyzed for the variation 1.

As a source of phenolic compounds banana peel extract was fortified in yogurts and it was reported with higher TPC, DPPH•, and ABTS+• scavenging ability, α-glucosidase inhibitory activity than control yogurts significantly (p < .05). The fortification of banana peel extract in yogurts significantly reduced the lipid oxidation and increased the viscosity [15]. The incorporation of banana peel extract in cake improved shelf life compared to control.

4. CONCLUSION

Currently artificial food colours are added to various food products to increase their appearance. Mostly we are familiar with their use in candies, other sweets, and soft drinks, but may not be aware of their widespread use in food products such as cheese, butter, and various prepared foods. In children the inclusion of food additives, especially food colours, causes hyperactivity and allergic responses as a short term

effect. Some of these food colours are reported to be carcinogenic as long term effect, typically red colour, are banned from food use. Presently, the demand for natural colours is increasing globally because of increased awareness on therapeutic nature, medicinal properties and also because of the documented profound toxicity of synthetic colours. Natural colourings are derived from natural sources like plants, insects, animals and minerals. Banana peel extract and its flour are used as additives in various food products to enhance nutrient and antioxidant properties [16]. Phytochemicals like alkaloids, terpenoids, saponins, proteins and steroids are present in both small and big banana. Present study records that small banana peel extract contain more amount of calcium, potassium, and sodium compared to big banana and incorporation in cake emboldens the use of banana peel extract as an effective natural source of antioxidant and antimicrobial sources.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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