Short Research Article

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

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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.

Keywords*: antioxidants, banana peel, cake, natural food colour, phytochemicals*

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 are 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 chattels, 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. Red Banana is noted its highest anthocyanin, phenolic and flavonoid contents [3]. The anthocyanin extract from banana peel shows antimicrobial activity against bacteria and fungi [4].

Naturally baked sweet dessert and a favorite course is cake. 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, pista, and other fruits [5].

In USA, the proximate principles of banana peels were estimated as 9.4% 6.7% and 11.5% for protein, fat and 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 tannin 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 foods 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 as a aim, the present study was framed with following objectives.

- To Analyse the phyto chemical and nutrient content of banana peel extract
- To incorporate banana peel extract in cake
- To undergo sensory, nutrient analysis with shelf life

2. MATERIAL AND METHODS

The banana of big (poovan - Mysore banana) and small (Morris - Cavendish banana) 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. Phytochemicals are chemical compounds produced by plants, usually help them to thrive or thwart competitors, pathogens. Phytochemicals are viewed as study compounds quite than essential nutrients [7]. Phytochemical test for Alkaloids, Terpenoids, Phenol, Sugar, Saponins, Flavonoids, Quinines, Proteins and Tannins were done. Moisture, ash with protein, carbohydrate, sodium, calcium, potassium and fibre were also analyzed by AOAC method [8].

Cake is a dessert which is classically baked. Generally cake requirements are flour, sugar, eggs, butter or margarine, leavening agents, like baking powder. Further with various substitutions for the primary ingredients and flavourings include dried, candied, or fresh fruit, nuts, cocoa, and extracts such as vanilla and saffron. Hence cake was chosen as a product to develop with incorporation of banana peel extract, nutrient Analysis and sensory evaluation was done for control and sample product.

2.1 Sensory, nutrient and shelf life analysis

Organoleptic evaluation of cake was assessed by 25 semi trained panel members by using score card with 9 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 control. The selected variation v1 through organoleptic evaluation which received higher acceptability score than other variations 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. Shelf life evaluation was also analysed for the developed product to know that the formulated and developed cake can be kept before it starts to deteriorate, in case any stated storage conditions.

3. RESULTS AND DISCUSSION

3.1 Phytochemicals

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 are performed and the results obtained are presented in table -1

Table 1. Phytochemical test

Test	Small Banana	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 phyto chemicals like phenol, sugar, flavonoids, qionines and tannins are found to be absent in the test.

3.2 Nutrient analysis

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 [9],[10].

Banana peel is eaten in many parts of world though it is not very common which contain high amount of vitamin B6 and B12 as well as magnesium and potassium also contain fibre, protein. These are not as sweet as banana. The following table -2 shows the nutrient analysis of banana peel extract.

Table 2. Nutrient analysis of banana peel (100g)

Nutrient	Small banana	Big banana
Protein(g)	1.3	2.2
Carbohydrate(g)	2.1	2.5
Sodium(µg/g)	223	115
Calcium(µg/g)	255	163
Potassium(µg/g)	234	123
Moisture	9%	9%
Ash	11%	11%
Fibre	62.8	65.2

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

3.3 DPPH assay and Total antioxidant

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 and hydrogen peroxide radical scavenging activity method. DPPH assay is a preliminary test to investigate the antioxidant potential of extracts. 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 was 0.137 and 0.215 respectively 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 [11].

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 [12]. In present study cake was developed with incorporated banana peel extract. Nutrient analysis and sensory evaluation was done

for the control and test sample products. The plate I was control product and plate II and III was the test sample variation I and II respectively from the below figure.

plate I Control product (cake) **plate II Variation -I** **plate III Variation -II**

Figure 1 Developed food products

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 and II have the highest overall acceptability.

Table 3. Mean organoleptic score for cake

Sensory characteristics	Standard	Variation 1	Variation 2
Appearance	4.5.±0.5	4.7±0.5	4.2±0.5
Colour	4.3±0.4	4.8±0.5	4.3±0.5
Flavor	4.6±0.5	4.5±0.5	3.5±0.5
Texture	4.0±0.5	4.7±0.5	3.1±0.5
Overall acceptability	4.4±0.3	4.8±0.5	3.0±0.5

It was scored 8 out of 9 on hedonic rate scaling. Organoleptic evaluation of cake was assessed by 25 semi trained panel members by using score card with 9 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 (VI, VII); variation VI 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.

3.6 Nutrient analysis

Vegetables and fruits peel are the most vital part helps to protect the body from deficiencies and diseases also to get rid of the free radicals, as it contains vitamins and minerals in addition to phenols which are antioxidant. Researches have proved the presence of vitamin C, E, B6 in banana peels.

Table 4. Nutrient analysis of control and sample

Nutrient	Control product (100g)	Sample incorporated with 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

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 over 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].

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].

Table 5. Shelf life evaluation

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

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

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. At present, 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. Phytochemicals like alkaloids, terpenoids, saponins, proteins and steroids are present in both small and big banana. The nutrient analysis of sample incorporated with banana peel was higher than control product with antioxidant activity.

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