Quality Attributes of Cake Made with Green Banana Fruit Peels

Esmat S. Mohamed
Biotechnology Department- Higher Institute for Agriculture Co-Operation-Shobra- Cairo- Egypt
Aziza H. Abd El zahir
Nutrition and Food Science Department- Faculty of Home Economics- Menoufia University

المجلة العلمية المحكمة لدراسات وبحوث التربية النوعية

المجلد العاشر – العدد الأول – مسلسل العدد (٢٣) – يناير ٢٠٢٤م

رقم الإيداع بدار الكتب ٢٤٢٧٤ لسنة ٢٠١٦

ISSN-Print: 2356-8690 ISSN-Online: 2974-4423

موقع المجلة عبر بنك المعرفة المصري https://jsezu.journals.ekb.eg

البريد الإلكتروني للمجلة E-mail JSROSE@foe.zu.edu.eg

Quality Attributes of Cake Made with Green Banana Fruit Peels

Esmat S. Mohamed
Biotechnology Department- Higher Institute for Agriculture Co-Operation-Shobra- Cairo- Egypt

Aziza H. Abd El zahir
Nutrition and Food Science Department- Faculty of Home Economics- Menoufia University

تاريخ رفع البحث: ٢٢-١٠-٢٠٢٣م
تاريخ تحكيم البحث: ١٠-١١-٢٠٢٣م
تاريخ مراجعة البحث: ٢١-١١-٢٠٢٣م
تاريخ نشر البحث: ٧-١-٢٠٢٤م

Abstract

Banana's consumption and its production produce a lot of peels, which are usually thrown away in the garbage and lead to environmental pollution. Peels are abundant sources of natural biological activity elements that are vital for avoiding illnesses. This study aimed to prepare cakes by adding green banana peels flour at three levels (10, 20, 30 and 40%) to produce cakes characterized with their good healthy properties and higher content of biological activity components. Chemical composition, rheological, physical, organoleptic, and antioxidant characteristics of cakes were studied. The findings confirmed that GBPF had greater antioxidant and nutritional characteristics. Data from farinographs of wheat flour added to GBPF revealed a rise in water absorption. The organoleptic evaluation of cakes containing up to 10% GBPF was once observed to be acceptable. The study recommends a 10% GBPF to enhance the nutritional value, antioxidant characteristics, and qualitative aspects of cakes while maintaining their health benefits.

Key words: Bananas wastes, bakery products, biologically active compounds-quality characteristics.

الملخص:

ينتج عن استهلاك الموز وإنتاجه الكثير من القشور، التي عادة ما يتم التخلص منها في القمامة وتؤدي إلى تلوث البيئة. القشور هي مصادر وفيرة لعناصر النشاط البيولوجي الطبيعي التي تعتبر حيوية لتجنب الأمراض. هدفت هذه الدراسة إلى تحضير الكيك بإضافة دقيق قشور الموز الأخضر بتركيزات مختلفة (١٠، ٢٠، ٣٠، ٤٠٪) لإنتاج كيك يتميز بخصائصه الصحية الجيدة ومحتوى أعلى من مكونات النشاط البيولوجي. تمت دراسة التركيب الكيميائي والخصائص الريولوجية والفيزيائية والحسية ومضادات الأكسدة للكيك. وأكدت النتائج أن دقيق قشر الموز الأخضر لديه خصائص مضادة للأكسدة وغذائية أكبر. كشفت البيانات المستمدة من صور الفارينوجراف لدقيق القمح المضافة إلى دقيق قشر الموز الأخضر عن زيادة في امتصاص الماء. وقد لوحظ أن التقييم الحسي للكيك الذي يحتوي على ما يصل إلى ١٠% من دقيق قشر

الموز الأخضر مقبول. توصي الدراسة بـ ١٠٪ دقيق قشر الموز الأخضر لتعزيز القيمة الغذائية وخصائص مضادات الأكسدة والجوانب النوعية للكيك مع الحفاظ على فوائدها الصحية.

الكلمات المفتاحية: مخلفات الموز، منتجات المخابز، المركبات النشطة بيولوجيا – خصائص الجودة.

Introduction

Bananas (*Musa sapietum*) are the most widely consumed ordinary tropical fruits available today. They are part of the *Musaceae* family. Huge amounts of banana peels, accounting for raw banana weights can extend by way of up to 40% due to by-products in the companies and / or after consumption that produce products dependent on bananas **(Zoair *et al.*, 2016)**. Fruit preparation produces a significant number of seeds and peels inside the by- products. This by-product is an important worldwide problem for reasons of economics, the environment, and food production **(Emaga *et al.*, 2007)**. Juice companies and fruit marketplaces often acquire significant amounts of banana peel waste, which is a precious bioresource and a duty for environmental conservation. It is possible to radically change waste into beneficial material rather than discarding it in trash dumps, reducing environmental and economic issues **(Abu El-Hassan, *et al.*, 2022)**. Banana peels is high in glucose, crude protein, crude fat, and total dietary fiber, as well as amino acids, fatty acids especially polyunsaturated, pectin, and trace elements. Because by-products are incredibly valuable, for that reason there has been activity in their usage to create practical dietary or ingredients with a significant quantity of nutrients (**Mohapatra *et al.*, 2010)**. Bioactive compounds found in nature contained in banana peels, including dietary fiber, carotenoids, and polyphenols, have health advantages such as cancer prevention, cardio disorder prevention, and further chronic disorders **(Oguntoyinbo, 2020)**. Gluten-free like banana peels can improve its nutritional, texture, and colour attributes without altering its traditional properties. **(Gomes *et al.*, 2020)**. Addition of banana peels flour which containing natural antioxidant such as flavonoids, polyphenols, and free radical scavenging activity makes the cake's nutritive content, organoleptic attributes, and mineral content more advantageous compared to the control cake **(Abu El-Hassan, *et al.*, 2022)**.

Cakes can be fed in a range of ways, whether they are spongy or buttery, easy, or crammed with cream, chocolate, or nuts. For a higher and extra vivacious taste of cakes, you can add fruit juices and its peels **(Hamid, 1993)**. Additionally, cakes have been viewed as especially healthy snacks that are preferable to those with empty calories that only provide 5 percent of the daily requirement of eight specific nutrients, such as soda or gum **(Cullen and Thompson, 2005)**. One of the top ten meals and drinks fed as snacks by excessive college youngsters is determined to be desserts and cookies. Cakes and different sweet, starchy snacks made up 21% of the snacks fed by kids between the ages of 2 and 11 (**Abdalla and Halaby, 1998**). Customers' preference for bakery items like sponge cakes suggests that it should be exploited to add Phyto-substances to people's meals **(Moraes *et al.*, 2010)**.

The most basic cakes include layer, sponge, and pound cakes, which have high calorie content and inadequate nutrition **(Schirmer *et al.*, 2012)**.

Additionally, doughs with and without the addition of 20% BPF. A higher content of BPF increased dough dryness which toughened handling of the tough. The dough also became brittle with a visibly intense dark color. Despite this, a darker color likely does not represent a limitation in biscuits acceptance since people associate them with healthier integral products (Castelo-Branco et al., 2017).

(Pa˘trascu *et al.*, 2017).

The goal of research was to evaluate the influence of add green banana peels flour in cake at various levels to decrease gluten and increase biological activity components, quality attributes, including the product's chemical, physical, rheological, antioxidant activity, and sensory properties.

Materials and methods

Materials

The fresh green bananas (Musa acuminata) have been obtained from a nearby farm in Giza City, Egypt.

Flour:

The flour made from wheat (72% extract) obtained the Nourth Cairo mills of the Cairo government of Egypt.

Additive ingredients:

Fresh eggs, butter, skimmed milk powder, baking powder and vanilla are all ingredients required to make the cake batter. These materials were bought at the Qalubeya neighborhood market., Qalubeya, Egypt.

Chemicals

Sigma Chemical Company supplied Folin-Ciocalteu reagent and standard chemicals, while Millipore Co., USA supplied deionized water for standard and reagent manufacturing, and El-Ghomhoria Co. for Trad. Drug., Chem., and Med. Instr. Egypt provided all additional chemicals and reagents, all of which were scientific laboratory grade.

Methods

Preparing flour from green banana peels

To prepare green banana peel flour and, to eliminate dirt, with the water that was flowing, the peels were gently cleaned. The pulp of the banana was separated from the skins. At 45°C, the peels had been dried for forty-eight hours after being sliced into little pieces (about 2.5 cm). It grinds with an air mill, a speedy speed blend (Molunix, France), and weights till the drying technique is finished, at which time it serves as the powdered seize, observed through flour wrapped in plastic containers and saved at -18 °C in the freezer until extra processes are carried out **(Raeker and Johnson, 1995)**.

Analytical techniques:

Applying the approach described in **(AOAC, 2005)**, moisture, protein (N x 6.25 Kjeldahl technique), fats (hexane solvent, Soxhielt devices), fibers, and ash have been measured.

Energy and carbohydrates content

Using differences, calculate carbohydrates was done as follows:

% Carbohydrates = 100 - (% Moisture +% Protein +% Fat +% Ach +% Fibers).x

According to **(FAO, 1982)**, Protein, carbohydrates, and fat were multiplied by 4.0, 4.0 and 9.0, respectively, to determine the calorie content.

Characterization of phenolic substances by HPLC

An Agilent 1200 chromatograph equipped with a PDA model G1315B, a Bin pump odel G1312A, an auto-sampler model G1313A, and an RR Zorbax Eclipse Plus C18 column (1.8 m, 151 mm, 4.7 mm) was once utilized to operate the HPLC evaluation of the extracts. Formic acid (0.2% in water) and acetonitrile have been the two cellular phases A and B, respectively. The elution was carried out using the solvent B gradient method at 0.95 ml per minute: From zero to 21 minutes, the percentages are as follows: 6–17%, 17–41%, 29–33 minutes, 41–71%, 71–99%, 37–46 minutes, 99%, and 99–95%.30. The injection had a 10 µl volume. Utilizing calibration curves created through HPLC from pure standards, the chemical compounds had been measured at wavelengths of 280 nm for flavan-3-ols and derivatives of benzoic acid, and 360 nm for flavonols and derivatives of cinnamic acid. The HPLC technique outlined by **Radovanovi *et al.*, (2010)** used to be utilized with a few minor adjustments to the waft charge and elution gradient.

Cake formula and ingredients:

Control cake dough was made in accordance with the formula of **Paul and Southgate, (1978)** presented in Table (1). Cake supplemented with GBPF were prepared using the same formula except for adding 5%, and 10% on the expense of wheat flour.

Table (1): The formula and ingredients of cake with green banana peels flour

Formulas (g)	**Cake**		
		GBPF	
	Control	**5%**	**10%**
Wheat flour (72% extraction)	100	95.0	90.0
Green banana peels flour	-	5	10
Sugar powder	50	50	50
Margarine	25	25	25
Fresh whole egg	15	15	15
Milk	50	50	50
Cocoa powder	10	10	10
Vanillin	0.25	0.25	0.25
Baking powder	3	3	3
Sodium chloride	1	1	1

Preparation of cake samples

Approved cake preparation procedures were slightly modified in accordance with **Raeker and Johnson, (1995)**. Except for the sugar, all the dry cake components were combined. The creamy butter and extra components had been blended in a mixing machine for three minutes at average speed. The powdered sugar was then added and mixed for three minutes. The overwhelmed eggs and vanilla were then brought in and overwhelmed for two minutes. The mixture of the creamed fats and sugar was then really crushed at low velocity for 5 minutes. The prior combination used to be gradually supplemented with different elements and blended for 5 minutes. The combination used to be poured into prepared tin shape pans of measurement 30, scaled into the cup, and baked at 180°C for 25 minutes. It was then permitted to cool. naturally at room temperature before being packaged in polyethylene. For the replacement cake, wheat flour has been incorporated with GBPF at the percentages of 0, 10, 20, 30, and 40%.

Rheological parameters

A farinograph assay was once carried out using a farinograph (type 810107, Brabender OHG, Germany) and the recommended approach (AACC, 2000) to assess the influences of incorporating specified quantities of green banana peel flour with wheat flour on the rheology of the dough. Evaluations have been made on the absorption of water, arrival and development times, dough stability, mixing tolerance index, and soften intensity.

Cake's physical characteristics

Weight: Cake was once weighted with the use of a repeating triple-diameter digital stability mannequin (Precise 205 A Super Bal. Swiss).

Volume: After 1 hour of chilling at room temperature (25°C), changing the green banana peel displacement was once used to measure cake volume.

Height: The ruler in the center of the cake was used to measure the height (cm^3).

Specific volume: Measurements for a certain specific volume have been made as follows:

$$\text{Specific volume} = \frac{\text{Cake volume } (cm^3)}{\text{Cake weight (g)}}$$

According to **Hussein *et al.*, (2011)**, the physical characteristics of cake was made.

Sensory evaluation

Cakes containing GBPF was examined organically for their sensory properties (color, flavor, taste, texture, mouth feel, appearance, and general acceptability). The assessment was finished using **Faridi and Rubenthaler's (1984)** methodology as follows:

Parameters	**Scores**
General appearance	20
Colour	15
Flavour	15
Texture	15
Taste	15
Overall acceptability	20
Total	**100**

Statistical analysis

The data were analyzed using a completely randomized factorial design **SAS, (1988)** when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test. Differences between treatments of ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

Results and discussion

The chemical constitution of flour is made from green banana peels.

Data in Table (1) demonstrates the proximate chemical constitution of green banana peel flour (GBPF). It is obvious to observe that the moisture, protein, fats, ash, fiber, carbohydrates, and energy value levels of GBPF as dry weight were 6.8٠, 0.95%, 1.72%, 9.21%, 30.52%, 57.60%, and 246.68 kcal/ 100g, respectively. These findings are in line with those of **El-Kholie *et al.*, (2021)**, who said that the energy value, moisture, protein, fats, aching, fibers, and carbs of banana peels were each 7.30%, 6.37 %, 8.13 %, 9.22%, 18.43%, and 300.85 kcal/100g, respectively. The high nutritional content of banana peels suggests that these substances are a plentiful source of essential components.

Table (2): Approximate chemical constitutions of GBPF (g/100g dry sample)

Characteristics	GBPF
Moisture (%)	6.80± 0.41
Protein (%)	0.95±0.43
Fat (%)	1.72± 0.37
Ash (%)	9.21± 0.61
Crude fiber (%)	30.52± 0.48
Carbohydrates (%)	57.60± 0.55
Energy value (Kcal/100g)	249.68± 0.70

GBPF= Green banana peel flour. Every result corresponds to the average variation from three replicates.

Evaluation of phenolic compounds of green banana peels flour

The data summarized in Table (2) demonstrated the HPLC technique's ability
to identify the phenolic components in GBPF. According to the data, quinic acid, chyrsin acid, and quercetin were the phenolic components found in GBPF in the highest concentrations. The values were, correspondingly, 1435.17, 453.12, and 77.68 mg/100g. But on the other side, coumarin, ferulic acid, and protocatechuic acid were shown to have the lowest phenolic components in GBPF. The values were, correspondingly, 0.71, 1.52, and 2.30 mg/100g. These results corroborate those of **Zhang *et al.*, (2022)**, who discovered that banana peel contains strong antioxidant capacity and contains a significant number of phenolic components. The principal phenolic constituents' concentration ratios were all highest in quinoic acid. Choosing the incorporation of as many nutritional supplements and meals components is made possible by way of banana peel resources with a widespread quantity of phenolic compounds, pharmaceutical formulation, and other products to their best ability as a low-cost source of phenolic substances.

Table (3): Estimation of phenolic substances of green banana peel flour Rheological properties of wheat flour with 10% green banana peels

Phenolic compounds	Concentration mg/100g
Gallic acid	4.13
Catechin	3.41
Quinic acid	1435.17
Quercetin	77.68
Cinnamic acid	8.14
Chlorogenic acid	15.98
Protocatechuic acid	2.30
Ferulic acid	1.52
Chyrsin	453.12
Cinnamic acid	8.01
Caffeic acid	3.18
Coumarin	0.71

The farinograph of wheat flour and wheat flour containing 10% green banana peel flour (GBPF) is displayed in Table (2). The effects reveal that wheat flour containing 10% GBPF has the highest water absorption rates in terms of percentage, arrival times, and dough formation times. The results were ٦٨%, 1.١ minutes, and 9.0 minutes, respectively.

According to the Brabender Unit (B.U.), wheat flour has the best dough stability and degree of softening. The values were 1١ minutes and 9.0 B.U. These outcomes confirm **Ahmad and Mohammad, (2022)**, they reported that with the addition of banana peel flour (BPF) at various levels, the water absorption capacity improved dramatically from ٥٨.٠ to 68 %. It might be because the percentage of fiber in dough has increased. Because banana peel is high in fiber, raising the flour replacement % raises the dough's fiber content, which increases its ability to absorb water. The development time of dough increased from ١.٤ to ٩.٠ minutes as the banana peel flour

concentration increased. Dough stability, also known as dough toughness, was shown to decline dramatically as the concentration of BPF increased. Furthermore, increasing the fiber content enhances the dough's ability to absorb water, leading to an improvement of dough form. For longer growth time was mostly due to the interaction of gluten with fibers, which dominated wheat proteins breakdown because of protein hydrolysis **(Liu *et al.*, 2018)**.

Table (4): Rheological properties of cake dough produced from wheat flour with 10% green banana peels and wheat flour control

Samples	Water absorption (%)	Arrival time (min)	Dough development (min)	Dough stability (min)	Degree of softening (B.U)
Wheat flour	5٨.00	1.00	1.٤0	1١.0	٨٩.0
Wheat flour + 10% GBPF	68.00	1.10	9.00	9.0	75.0

Physical measurements of incorporated cake with green banana peel flour

The results of a study on the influence of 10% GBPF replacement on the cake's physical attributes are shown in Table (4). The findings demonstrated that all the selected GBPF treatments resulted in a small reduction in cake height without an exchange that is statistically considerable (P≤ 0.05). There have been 4.25 and 3.61 cm3 on average, respectively. In terms of cake weight, the data showed that using GBPF instead of 10% wheat flour resulted in a considerable (P≤0.05) increase in cake weight in contrast to control cake., which was 64.25 g and 66.13 g, respectively.

The specific volume of the cake when 10% of the wheat flour used to be changed with GBPF as a substitute of the control cake, was considerably lower (P≤ 0.05) than it was once for the wheat flour-only cake, which had a specific volume of 2.58 and 2.30%, respectively.

The data showed that the volume and crust coloration of the cake had been appreciably decreased (P≤0.05) when 10% of the wheat flour used was changed with GBPF, as in contrast to the cake control. In that sequence, the average readings were 163.0, 154.0, 50.20, and 46.30 cm^3. These findings agree with those in **(Akter and Alim, 2018)**, who observed that considering a cooked cake's volume determines how much air can still be present on a completed item. Increasing specific volume results from the product expanding and retaining extra gas. Additionally, the specific volume rapidly dropped when more different flours were substituted in the cake.

Additionally, there had been no considerable variation in the weight of the cake samples in contrast to the control. On the other hand, substituting banana peel powder (BPP) for cake decreased its volume. However, the specific volume exhibits a tendency to decrease to some in BPP. However, when the amount of BPP replacement increases, the density of cakes exhibits a contradictory sample **(Khaled *et al.*, 2023)**.

Table (5): Physical characteristics of cakes blended with 10% GBPF

Type of cake	Height (cm^3)	Weight (g)	Volume (cm^3)	Specific volume (%)	Crust color
Control cake	4.25 $\pm 0.2^a$	64.25 $\pm 2.4^b$	163.0 $\pm 5.0^a$	2.58 $\pm 1.3^b$	50.20 $\pm 6.2^a$
Cake + 10% GBPF	3.61 $\pm 0.4^a$	66.13 $\pm 3.1^a$	154.0 $\pm 2.0^b$	2.30 $\pm 1.5^a$	46.30 $\pm 4.1^b$

GBPF= Green banana peel flour. Each result corresponds to the standard variation from three trials. Values with different superscript letters in the identical columns are considerably varied at P≤ 0.05.

The chemical constitution of the cake that contains GBPF:

The chemical constituents of cake in combination with GBPF are displayed as dray weight in the information presented in Table (5). It is obvious to see that the cake replaced with 10% GBPF had the highest moisture, fat, ash, and fiber content, with a notable variation. The respective mean values were 14.10, 12.04, 1.10 and 0.20 %. With a notable variation (P≤0.05), the control cake made completely from wheat flour had the greatest protein and carbohydrate contents, 7.38 and 65.04%, respectively.

On the contrary, the cake replaced with 10% GBPF had the greatest energy value, 402.16 kcal/100g, with a notable variation (P≤0.05). According to these results, which are consistent with **(Ahmed *et al.*,**

2021), bananas can be used in food manufacturing as a great supplier of micro and macro nutrients, antimicrobials, and antioxidants. Banana research indicates that more than 50.70 percent of the weight of the banana fruit that is discarded can be utilized. Furthermore, protein and ash which were 15.10 and 25.19% are regarded as good sources of nutrition in banana peel flour. As the concentration of raised, the actual quantity of GBPF used in cake gradually decreased.

Additionally, **AL-Sayed and Ahmed, (2013)**, discovered that the caloric value of the cake formula increased with the amounts of flour made from GBPF. The gradual use of GBPF may have caused the following results: Added protein and fat because of using banana peel flour instead of regular flour. Overall, it was determined that cakes made with banana peel flour had excellent nutritional qualities in terms of their protein and ash contents, which means the food is fortified with nutrients that are otherwise lacking in a daily diet.

Likewise, the cake that had 10% unripe banana peel powder (UBPP) had greater fiber than the control sample. The UBPP-incorporated cakes' higher fiber content justifies the nutritional value of banana peel **(Olushola, 2006)**. Utilizing fiber-rich plant foods will decrease blood cholesterol levels and promote bowel motion through the intestines as a laxative. Additionally, greater nutritional vitamins and minerals are provided by increasing dietary fiber consumption **(American Academy of Pediatrics, 2012)**.

Table (6): Chemical composition of macronutrients in cake by added 10% GBPF as (g/100gDray Basis.)

Components	Cake control (100%wheat flour)	Cake with 10% GBPF	LSD ($P \leq 0.05$)
Moisture	13.24±0.40[a]	14.10±0.40[a]	1.250
Protein	7.38±0.02[a]	7.04±0.02[a]	1.140
Fat	11.00±0.03[a]	12.04±0.01[a]	1.242
Fiber	0.17±0.01[a]	0.20±0.40[a]	0.307
Ash	0.03±0.02[b]	1.10±0.07[a]	0.670
Carbohydrates	65.04±0.51[a]	62.26±0.60[b]	2.570
Energy value (Kcal/100g)	404.41±0.37[b]	402.16±0.42[b]	3.810

GBPP= Green banana peel powder

Each result corresponds to the standard variation from three trials. Values with different superscript letters in the identical columns are considerably varied at $P \leq 0.05$.

Cake sensory attributes incorporated with GBPF.

The organoleptic attributes of cake manufactured mainly from GBPF, and wheat flour are affected by the manufacturing-related components. They were also closely related to the specifications for physicochemical uniformity for these items. The consistency of cake has frequently been determined through sensory evaluation and estimation. As a consequence, the sensory quality traits of cakes that had been partly substituted with GBPF at degrees of 10, 20, 30, and 40% have been assessed. These characteristics covered overall appearance, flavor, and taste, crust color, crumbs color, and crumbs texture.

Table (6) displays the organoleptic characteristics of cake that has been combined with GBPF. It is obvious to state that the control cake sample (made with 100% wheat flour) received the highest scores for all the measured sensory qualities (color, taste, flavor, mouth feel, form, crispness, appearance, and overall acceptability). The average scores were between 8.0 and 8.5.

Data from Table (6) shows that when GBPF replacement increased in cake samples, all sensory qualities assessed saw a decline at varying rates. Cake samples with 40% replacement levels had the worst sensory characteristics ever documented. The lowest scores varied from 4.5 to 4.7.

As a result, it was used in the cake sample in this research. On the contrary, a 10% replacement of GBPF in cake testing resulted in a minor decline in all sensory attributes with no discernible change from control cake. The average score was in the 7.5-7.9 range. It was observed that adding 20% or more GBPF to a cake generated a comparatively darker color may be the cause by the enzymatic browning. The outcomes that were attained were in line with **(Ahmed *et al.*, 2021)**, observed that the cake's sensory stability characteristics exhibited a slightly significant change when compared to the original item, with those which incorporate banana peel flour A maximum 6 percent of all sensory characteristics tested and rated as outstanding. As a result of this study, it is advised that GBPF be added at a level of a maximum of fifteen percent can be added to cakes to enhance their qualitative aspects, while also providing several health advantages.

Table (7): Sensory properties of cake incorporated with different levels of GBPF.

Items / GBPF levels	Color	Flavor	Taste	Texture	Crisp-ness	Appe a-rance	Mouth feeling	Overall accept a-bility
Control	8.00± 0.17[a]	8.00± 0.15[a]	8.00± 0.15[a]	8.00± 0.14[a]	8.00 ± 0.13[a]	8.20± 0.17[a]	8.20± 0.25[a]	8.50± 0.30[a]
10%GBFP	7.70± 0.14[a]	7.50± 0.14[a]	7.70± 0.14[a]	7.50± 0.13[a]	7.60 ± 0.16[a]	7.90± 0.13[a]	7.80± 0.12[a]	7.70± 0.25[a]
20% GBPF	7.10± 0.15[b]	7.30± 0.12[b]	7.50± 0.12[ab]	7.20± 0.11[b]	7.30 ± 0.14[b]	7.80± 0.14[a]	7.60± 0.10[b]	7.50± 0.22[b]
30% GBPF	5.50± 0.16[c]	5.50± 0.10[c]	5.60± 0.10[b]	5.50± 0.07[c]	5.40 ± 0.12[c]	5.70± 0.09[c]	5.70± 0.09[c]	5.60± 0.14[c]
40% GBPF	4.50± 1.5[d]	4.60± 0.10[d]	4.70± 0.08[c]	4.60± 0.09[d]	4.50 ± 0.10[d]	4.60± 0.07[d]	4.50± 0.11[d]	4.50± 0.13[d]

GBPP= Green banana peel flour

Each result corresponds to the standard variation from three trials. Values with different superscript letters in the identical columns are considerably varied at P≤ 0.05.

Conclusion

Overall results showed that it is possible to prepare cakes with similar physical, sensory and rheological qualities characteristics to the cake control when flour was substituted by different levels of green banana peel flour especially 10%. It also led to the addition of green banana peel flour led to increased cake contents of vital nutrients such as antioxidants, natural bioactive components and crude fiber, a high nutritive and therapeutic values.

References

AACC,(2000): Approved Methods of the American Association of Cereal Chemists. Published by *American Association of Cereal Chemists*, ; 10 [Ed]. St. Paul, Minnesota, U.S.A.

Abdalla, E.S. and Halaby, M.S.(1998): Children, and snacks. *Bulletin of High Institute of Public Health. Univ. Alex.* ; 28 (2): 227-44.

Abu El-Hassan, A.M.; Roby, M.H.; Rabee, L.A. and Abd-Eltawab, S.A. (2022): Chemical, microbiological and antioxidant effects of banana peels on butter cake. *Egypt. J. Food. Sci.*, 50 (2)**:** 241-250.

Ahmad, F. and **Mohammad, Z.H.(2022) : Effect of the addition of banana peel flour on the shelf life and antioxidant properties of cookies**. ***ACS Food Science & Technology*, ; 2 (8): 1355-1363.**

Ahmed, Z.; El-Sharnouby, G.A. and EL-Waseif, M.A.(2021): Use of banana peel as a by-product to increase the nutritive value of the cake. *J. of Food and Dairy Sci.*, Mansoura Univ., 12 (4): 87-97.

Akter, N. and Alim, M.A. (2018): Preparation of wheat-potato-peanut composite flour cakes, *J. Bangladesh Agric. Univ.*, 16 (2): 315-321.

AL-Sayed, A. and Ahmed, R. (2013): Utilization of watermelon rinds and sharlyn melon peels as a natural source of dietary fiber and antioxidants in cake. *Annals of Agricultural Science*,**;** 58 (1): 83-95.

American Academy of Pediatrics.(2012): Fiber: An Important Part of Your Teen's Diet Healthy Children. 26/09/2012 from www.healthy. children. org/ English/ages.

AOAC,(2005): Methods of Analysis of AOAC International, 18th edition, *AOAC International. Gaithersburg*, Maryland 20877-2417, VA.

Castelo-Branco, V.N.; Guimarães, J.N.; Souza, L.; Guedes, M.R.; Silva, P.M.; Ferrão, L.L. and Miyahira, R.F. (2017): The use of green banana (*Musa balbisiana*) pulp and peel flour as an ingredient for tagliatelle pasta. Brazilian Journal of Food Technology, 20: 1-8.

Cullen, K.W. and Thompson, D.I. (2005): Texas School Food Policy Change Related to Middle School a la Carte/ Snack Bar Foods: Potential Saving in Kilocalories. *J. Am. Dietet. ADA*, **;** 105 (12): 1952- 1954.

El-Kholie, E.M.; Khader, S.A. and Ali, H.M.(2021) : Utilization of mango and banana Peels to produce cake. Journal of Home Economics, *JHE*, **;** 31(3): 87-100.

Emaga, H.T.; Andrianaivo, R.H.; Wathelet, B.; Tchango, J. and Paquot, M.(2007): Effects of the stage of maturation and varieties on the chemical composition of banana and plantain peels. *Food Chemistry*, 103: 590-600.

FAO, (1982) : Food and Agriculture Organization" Food Composition Tables for the Near East, F.A.O., *Food and Nutrition Paper*, **;** p. 26.

Faridi, H.A. and Rubenthaler, G.L. (1984): Effect of baking time and temperature on bread quality. *Cereal Chem.*, ; 61 (2): 13-20.

Gomes, S., Vieira, B., Barbosa, C., and Pinheiro, R.(2020): Evaluation of mature banana peel flour on physical, chemical, and texture properties of a gluten-free Rissol. *Journal of Food Processing and Preservation*, **,** 1: 1-6.

Hamid M.I. (1993): Utilization of Mandarin fruits for improving some bakery and beverage products. *Egyptian J. Food Science,* 21(1): 87- 95.

Hussein, E.A.; El-Beltagy, A.E. and Gaafar, A.M. (2011): Production and quality evaluation of low-calorie cake. *American Journal of food Technology,* **;** 6 (9): 827-834.

Khaled, B.M.; Alam, S.M.S.; Rana, M.S.; Sina, A.A.; Mahmud, M.S. and Hosen, M.Z.(2023): Evaluation of the quality parameters of wheat flour and banana peel powder formulated cakes. *Food Research,* **;** 7 (4): 161-170.

Liu, X.; Mu, T.; Sun, H.; Zhang, M. , (2018) : Influence of different hydrocolloids on dough thermo-mechanical properties and in vitro starch digestibility of gluten-free steamed bread based on potato flour. *Food Chem.,* **;** 239: 1064-1074.

Mohapatra, D.; Sabyasachi, M. and Namrata, S.(2010): Banana, and its by-product utilization: an overview. *Journal of Scientific and Industrial Research,* **,** 69: 323-329.

Moraes, E.A.; Dantas, M.I.; Morais, D.D.; Silva, C.O.; Castro, F.A.; Martino, H.S. and Sônia, M.R. (2010) : Sensory evaluation and nutritional value of cakes prepared with whole flaxseed flour. *Food Science and Technology (Campinas),* **;** 30: 974-979.

Oguntoyinbo, O. O., Olumurewa, J. A. V., and Omoba, O. S. (2020), Chemical composition, dietary fiber, and antioxidant activity of fermented ripe banana peel flour. *Journal of Food Stability,* **(2020),** 3 (2): 27-42.

Olushola, A.T.E.(2006): The Miracle Tree, *Moringa oleifera* (Drumstick). In Achieve Vibrant Health with Nature, Keep Hope Alive Series 1, *Unijos Consultancy Limited Press,* **;** p. 120-136. Nigeria.

Paul, A.A. and Southgate, D.A.T. (1978) : The composition of foods. *McCance and Widdowson's (4th Ed.), H.M. Stationery Office* **.** London, United Kingdom .

Radovanović, B.C.; Radovanović, A.N. and Souquet, J.M.(2010): Phenolic profile and free radical-scavenging activity of Cabernet Sauvignon wines of different geographical origins from the Balkan region. *J. Sci. Food Agric.,* 90: 2455-2461.

Raeker, M.O. and Johnson, L.A. (1995): Thermal and Functional Properties of Bovine Blood Plasma and Egg White Proteins. *Journal of Food Science*,**;** 60(4):685-690.

SAS, (1988): SAS Users Guide: Statistics version 5th Ed. SAS. Institute Inc., Cary N.C.

Schirmer, M.; Jekle, M.; Arendt, E. and Becker, T.(2012): Physicochemical interactions of polydextrose for sucrose replacement in pound cake. *Food Research International.*, 48 (1): 291-298.

Zhang, H.; Wang, Y.; Yang, B. and Yongping Li, Y. (2022): Profiling of phenolic compounds of fruit peels of different ecotype bananas derived from domestic and imported cultivars with different maturity. *Horticulturae,* 8 (70): 1-15.

Zoair, A.S.; Attia, R.S.; Abou Garbia, H.A. and Youssef, M.M. (2016) : Utilization of orange, banana and potato peels in formulating functional cupcakes and crackers. *Alexandria Journal of Food Science and Technology,* 367 (4210): 1-8.