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Determination of Unripe Banana Flour as Functional Ingredient on Physical Properties of Cake Batter

Hosseinvand A[1]* and Sorkhineja A[2]

[1]Department of Food Science and Technology, Islamic Azad University, Shahr-e-Qods, Tehran, Iran
[2]Department of Chemistry, Islamic Azad University, Karaj, Tehran, Iran

Abstract

Food waste problem is becoming one of the important and crucial issues at the globalization levels. In this study, researchers try to prevent Banana fruit waste converting to Banana flour as ingredient with long shelf life. Bakery products are probably one of the most important foodstuffs in the world. In traditional methods for preparation bakery products main ingredients were wheat or barley flours. In this present study the influence of Unripe Banana Flour (UBF) as a functional flour replacer on Color attributes, pH value, and specific gravity of cake batter was studied. The results indicated that all UBF cake batter formulation had significantly lower in lightness. Moreover, Lightness (L*-Value) of the UBF samples were darkness than control sample. In view of pH value, all the UBF samples were lower than testifier. These UBF samples showed lower specific gravity than control sample. According to the results, this study shows good potential for application of UBF as functional ingredient to be used as part of flour replacer in cake batter.

Keywords: Cake batter; Color attribute; Flour replacement; pH value; Unripe banana flour

Introduction

In recent years, most people would like to use new food products with novel formulation or ingredients. In briefly, whole banana is full of minerals, Vitamins, micronutrients (P, K, Fe) and other substance that is useful and benefit for humans and application of banana peels, leaves and sheaths is common in industries [1]. In generally, many kinds of fruits and vegetables are wasted during the storage and transportation. One of the valuable activities to prevent food waste in supply chain is by converting raw materials to ingredients that are having high ability of storage than raw materials. However, several researches were done for production of Ripe and Unripe Banana Flour in Bakery products [2-4]. Unripe Banana Flour is one of the most importance sources of phenolic compounds and nutritional composition [2]. The objective of this present study was to develop and evaluate Unripe Banana Flour as natural nutritional ingredient and flour replacer on some physicochemical properties and its application in cake batter.

Materials and Methods

Materials

The main ingredients used in cake were: wheat flour (82% extract, white flour company, Mashhad, Iran); sun flower oil (Vioni, Iran); Skim milk (caseinate company LTD, Iran); vanilla powder (Nelsen. Massey, USA). The remaining ingredients such as salt, sugar, whole egg, baking powder were purchasing from local market.

Chemical composition of wheat flour

Protein, ash and moisture were analyzed according to AACC methods 46-13, 08-01 [5] and ICC 46-12 [6], respectively. All analyses were performed in triplicate.

Unripe banana flour preparation

Green (Unripe) banana (*Musa sapientum*) fruit was purchased from local market in Tehran, Iran. The experimental method with some combination with other methods [2,3] were presented in Figure 1.

Preparation of cake batter

The traditional sponge cake batter in this present study was adapted from the work of Lee et al. [7]. The formulate of cake batter with UBF was added in different amounts (12%, 25% and 50%) to the cake batter were shown in Table 1. In first step, whole egg with sugar were taken in a container to whipping to a cream with mixer (Lux-R Spiral Mixer, Erica Record Company, USA) at a speed 3 for 5 min. In addition, wheat flour made with UBF blended and by baking powder was added to the container for mixing for 2 min with 2 speeds. Finally, sunflower oil and other ingredients were added to the container and allowed to rest, further physical experiment is done for the cake batter.

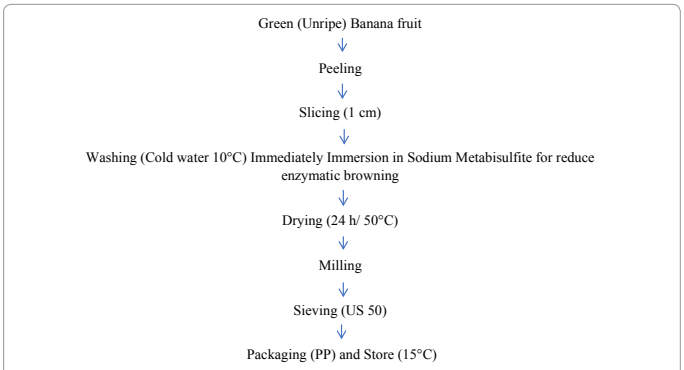

Figure 1: Flow chart on prepare unripe banana flour based on experimental method.

pH measurement

The pH of cake batter was determined using AOAC standard methods [8] for each batch at 24°C. Measurements was performed in triplicate.

***Corresponding author:** Hosseinvand A, Department of Food Science and Technology, Islamic Azad University, Kalhor BLVD, Shahr-e-Qods, Tehran, Iran, Tel: 009888078874; E-mail: Amir.Hosvnd@yahoo.com

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Color measurement

The cake batter samples were measured for color attributes in L*(Lightness), a*(redness) and b*(yellowness) system using a Minolta Chroma Meter (CR-400/410, Konica Minolta Holding, INC., Tokyo, Japan).

Cake specific gravity

The specific gravity of cake batter samples was measured as the ratio of the weight of the standard container filled with batter to that of the same container filled with water. Standard deviation for all determinations were 0.017 g/cm^3.

Statistical analysis

The data were recorded to analysis of variance (ANOVA) and the significance of the difference between means was determined by DUNCANS multiple range test ($p<0.05$) by using SPSS statistical software (Version 19; SPSS Inc., Chicago, IL, USA). All the tests were performed in triplicate.

Ingredients/Treatments*	BF1	BF2	BF3	BF4
Wheat Flour	35	30.625	26.25	17.5
Banana Flour	0	4.375	8.75	17.5
Whole Egg	8			
Sugar	20.6			
Water	11			
Vanilla	0.1			
Baking Powder	1.1			
Salt	0.3			
Skim Milk	3.9			
Oil	20			
Total	100			
*BF1: Control; BF2: 12.5% Banana flour; BF3: 25% Banana flour; BF4: 50% Banana flour				

Table 1: Formulation of cake batter prepared with unripe banana flour.

Properties	Amount (%)
Protein	10.90 ± 0.11
Ash	0.58 ± 0.01
Moisture	13.3 ± 0.02

Table 2: Chemical composition of wheat flour presented in Table 1.

Samples	pH	Specific gravity (g/cc)
BF1	7.51 ± 0.12^a	0.96 ± 0.32^a
BF2	7.46 ± 0.39^b	0.94 ± 0.25^b
BF3	7.36 ± 0.33^c	0.92 ± 0.36^c
BF4	7.30 ± 0.11^d	0.89 ± 0.21^d
pH group: p>0.05; Specific gravity group p<0.05 *BF1: Control; BF2: 12.5% Banana flour; BF3: 25% Banana flour; BF4: 50% Banana flour Values with the same superscripts in the same column are not significantly (p>0.05) different.		

Table 3: Physical properties of cake batters.

Samples	L*	a*	b*
BF1	77.11 ± 0.17^a	-1.20 ± 0.10^c	19.036 ± 0.10^c
BF2	70.32 ± 0.32^b	1.34 ± 0.31^b	18.30 ± 0.11^b
BF3	65.1 ± 0.4^c	2.33 ± 0.29^a	22.07 ± 0.40^a
BF4	61.06 ± 0.37^d	2.29 ± 0.66^a	22.01 ± 0.48^a
*BF1: Control; BF2: 12.5% Banana flour; BF3: 25% Banana flour; BF4: 50% Banana flour Values with the same superscripts in the same column are not significantly (p>0.05) different			

Table 4: Color measurement of UBF cake batter samples.

Results and Discussion

Chemical composition of wheat flour

Chemical composition of wheat flour presented in Table 2.

pH value

pH value and specific gravity of the cake batter with and without prepared by UBF are presented in Table 3. There was no significant difference ($p>0.05$) in pH value of all cake batter's formulation with and without UBF. Moreover, the pH values of all samples decreased with increasing level of UBF concentration. BF4 had the lowest pH, and BF1 had the highest. In this present research, the decrease in the cake batter pH values may be causal of decreased wheat flour protein (Gluten) in UBF samples formulation.

Cake batter specific gravity

According to previous research, specific gravity of cake batter had been directly influencing the taste, volume and texture of bakery final products. Results indicated that cake batter formulation with UBF decreased the specific gravity value significantly ($p<0.05$) with increasing level of concentration. All UBF samples had lower specific gravity than control sample that indicated the ability of cake batter formulation with UBF to increasing air bubbles incorporation into the oil in water cake batter emulsion [9]. In addition, there is relationship between specific gravity and amount and types of cake batter proteins. It seems, that high amount and network of wheat flour proteins in testifier sample basically influences air trap in cake dough [10].

Color measurement

The color attributes on UBF and control sample are shown in Table 4. According to results, the testifier sample (BF1) and BF4 samples containing 50% UBF showed lowest and highest level in lightness (L*-value), respectively. It seems that color of UBF application in cake batter getting darkness with increasing level of concentration. Mayer and Harel [11], Walker and Ferrar [12] reported that oxidation of phenolic compounds by polyphenol oxidase (PPO) is mainly and basically reason of enzymatic browning reaction in many widely of fruits. On the other hand, degree of browning reaction in banana after peeling directly depended to PPO activity. The upper b* value was observed in BF3 treatment, but there was no significant difference between BF3 and BF4 samples. These results agree with those obtained by Saifullah et al. [4] who observed that Banana pulp flour yellow noodle had lower lightness (L*-Value) than control sample. One the other hand, color of Banana depends on origin and variation.

Conclusion

From the results of the present work, it could be concluded that UBF played functional and nutritional role in cake batter or other bakery products as part of flour or ingredients replacer. The most significant color changes occur in cake batter prepared with UBF. Finally, UBF is suitable and proper based natural ingredient that had technically potential to widely use in food industries. Meanwhile, the data in our study may provide the basis for future researches.

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