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Determination of Unripe Banana Flour as functional ingredient on physical properties of cake batter

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Abstract

Bakery products are probably one of the most important foodstuffs in the world. 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. The upper b*-value was observed in BF3 treatment, but there was no significant difference between BF_3 and BF_4 samples. There was no significant ($P > 0.05$) difference in pH value of all cake batters formulation with and without UBF. Moreover, the pH values of all samples decreased with increasing level of UBF concentration. In view of pH value, all of 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

1. Introduction

In recent years, most of 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 also application of banana peels, leaves and sheaths is common in industries [1]. In generally, many kind of fruits and vegetables wasted during the storage times and transferred between places. One of the valuable activities to prevention of food waste supply chain is converted raw materials to ingredients that are high ability to storage than raw materials. However, several researches have done for production of Ripe and Unripe Banana Flour in Bakery products [1, 2, 3]. Moreover, 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 evaluate and develop of Unripe Banana Flour as natural nutritional ingredient as flour replacer on some physicochemical properties and it application on cake batter. But there seems to be published any research about present topic.

2. Materials and Methods

Materials: Cake ingredients 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

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methods 46-13, 08-01 and ICC 46-12, respectively [4-5]. 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 is presented in Fig 1. [2-3].

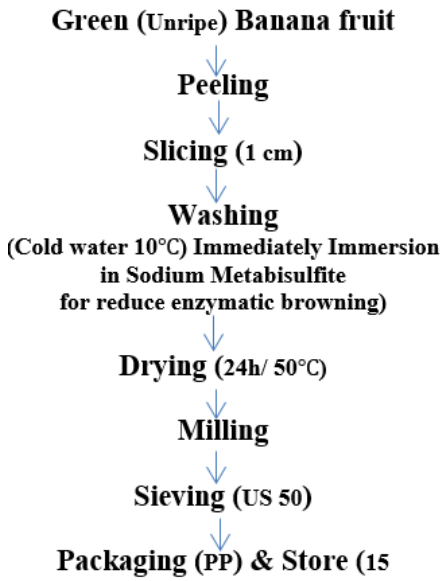

Figure 1. Flow chart on prepare Unripe Banana Flour based on experimental method

Preparation of cake Batter: The traditional sponge cake batter in this present study was adapted from the work [5]. The formulation of cake batter with UBF was added in different amounts (12, 25 and 50%) to the cake batter were shown in Table1.

In first step, whole egg with sugar were added to 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 with UBF blended and by baking powder was added to the container for mixing for 2 min with 2 speeds. Finally, sun flower and other ingredients were added to container and to take rest to cake batter for physical experimental.

pH Measurement: The pH of cake batter was determined using AOAC standard method [6] for each batch at 24©. Measurement was performed in triplicate.

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 were measured as the ration 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$\frac{gr}{cm^3}$.

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 of the tests were performed in triplicate.

Table1. Formulation of cake batter prepared with Unripe Banana Flour

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.

3. Result and Discussion

Chemical composition of wheat flour

Chemical composition of wheat flour presented in Table 1.

Table 1. Chemical composition of wheat flour

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

pH value

pH value and specific gravity of the cake batter with and without prepared with UBF are presented in Table 2. There was no significant ($P > 0.05$) difference in pH value of all cake batters 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 influence of 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 of UBF samples had lower specific gravity than control sample that indicated to ability of cake batters formulation with UBF to increasing air bubbles incorporation into the oil in water cake batter emulsion [7].

In addition, there is another direct relationship between specific gravity and amount of types of cake batter proteins. It seems, that high amount with network structure of wheat flour proteins in testifier sample basically influence on air trap in cake dough [8].

Table 2. Physical properties of cake batters

samples	pH	Specific gravity g/cc
BF1	$\mathbf{7.51 \pm 0.12^a}$	$\mathbf{0.96 \pm 0.32^a}$
BF2	$\mathbf{7.46 \pm 0.39^b}$	$\mathbf{0.94 \pm 0.25^b}$
BF3	$\mathbf{7.36 \pm 0.33^c}$	$\mathbf{0.92 \pm 0.36^c}$
BF4	$\mathbf{7.30 \pm 0.11^d}$	$\mathbf{0.89 \pm 0.21^d}$

*BF1: Control, BF2: 12.5% Banana flour, BF3: 25% Banana flour, BF4: 50% Banana flour.

Color measurement

The color attributes on UBF and control sample are shown in Table 3. According to results, the testifier sample (BF1) and also 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. Scientifics reported that oxidation of phenolic compounds by polyphenol oxidase (PPO) is mainly and basically reason of enzymatic browning reaction in many widely of fruits [9-10]. 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 researchers, who observed that Banana pulp flour yellow noodle had lower lightness (L*- Value) than control sample [11].

Table 3. Color measurement of UBF cake batter 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

4. Conclusion

From the results of the present work, it could be conclude 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.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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