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Effect of Pumpkin Powder on Physico-chemical Properties of Cake

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Abstract

The effect of the supplementation of pumpkin powder at a rate of 5%, 10% and 15% on physico-chemical properties of cake was evaluated in this study. It was observed that pumpkin powder showed significant effect on the proximate compositions of cake. Moisture, ash and protein content were found to be increased, whereas fat and total carbohydrate decreased with the addition of pumpkin powder. It was revealed that tough crumb with slight rough crust characteristic was resulted in 15% pumpkin blended cake among samples. However, sample C (10% pumpkin powder) was scored with the highest values based on organoleptic properties among pumpkin powder blended cakes. Pumpkin powder could be used potentially with wheat flour in cake preparation to minimize the postharvest loss of fresh pumpkin and as a rich source of nutrients especially β-carotene to meet the daily requirement of vitamin A.

Keywords: Pumpkin powder, Pumpkin, Physico-Chemical, Sensory Properties, Cake.

Introduction

Pumpkin (*Cucurbita moschata*) belongs to the family Cucurbitaceae and is one of the most grown vegetables in the tropical and sub-tropical countries including Bangladesh. According to data of BBS[1], production of pumpkin in Bangladesh is almost 20-25 m ton/ha. It is grown throughout the year but 90% of the total pumpkin is produced from January to June in Bangladesh. The green color of pumpkin changed to yellow, orange or red with the change of maturity stage because of carotenoids. It is one of most grown and consumed vegetables because of its high productivity, longer storability, better transport quality and nutritive value.

It is a rich source of carotenoids, ascorbic acid, minerals and vitamins among colored vegetables, and these nutrients have major role as precursor of vitamin A and antioxidant in human health[2]. Several researches show that β-carotene of pumpkin acts against carcinogenesis and heart diseases[3,4]. It has been reported that carotenoid content in red pumpkin is higher than some carrots[5].

It is also reported that inferior post-harvest management and storage facility result in 20-30% post-harvest loss of horticultural produces including pumpkin. Therefore, pumpkin is commonly consumed in fried or cooked form in Bangladesh. Considering the shelf-life of fresh pumpkin, it can be dehydrated for longer storability. It also has been reported that pumpkin could also be processed into flour for the diversification in the production of bakery products. Moreover, pumpkin powder can be used as supplement with wheat flour during the preparation of bread, biscuit, cookies, noodles, cake and as natural coloring agent in pasta and other mixes because of attractive flavor, color and sweetness[6].

In Bangladesh, cake is very much preferred bakery product by all ages people. Moreover, it would be a great scope to provide nutritional variation in diet by developing value added cake using pumpkin powder with wheat flour. Cake prepared with pumpkin powder would help to lower the vitamin A deficiency that is still common in developing countries. Even, there is no published document in Bangladesh regarding cake developed with pumpkin powder. The objective of the research work was to evaluate the effect of different levels of pumpkin powder on physico-chemical and sensory attributes of cake and to minimize postharvest loss of pumpkin by developing value added product.

Materials and Methods

Preparation of pumpkin powder: Mature pumpkin was purchased from the local market 'Basherhat', Dinajpur. Then it was peeled, deseeded to separate the edible portion and washed in tap water to clean. Trimmed pumpkin was then sliced in small pieces and boiled at 71-80^{0}C for 10 minutes for blanching. Treated pumpkin slices were then subjected to drying in cabinet dryer at 60^{0}C for 8 hr by following the drying method of Pongjanta *et al.*[7]. The dried pumpkin slices were ground into powder, sieved and stored at ambient condition in sealed polyethylene bags.

Formulation of cake: Basic ingredients of like including wheat flour, egg, sugar, baking powder, milk powder, oil and others were purchased from supermarket. Formulations of cake preparation are given below in Table-1.

Table-1
Formulation of cake preparation on 100 g flour basis

Ingredients	Sample A	Sample B	Sample C	Sample D
Wheat flour (g)	100.00	95.00	90.00	85.00
Pumpkin powder (g)	0.00	5.00	10.00	15.00
Sugar (g)	83.00	83.00	83.00	83.00
Egg (no)	2	2	2	2
Backing powder (g)	2.66	2.66	2.66	2.66
Milk powder (g)	33.30	33.30	33.30	33.30
Vanilla essence (ml)	1.60	1.60	1.60	1.60
Oil (ml)	50.00	50.00	50.00	50.00

Preparation of cake: Three levels of pumpkin powder (5%, 10% and 15%) were substituted with wheat flour in the preparation of pumpkin powder blended cake. Other ingredients were added by following the formulation given in Table-1. The method of Cesarani and Kinton[8] with a slight modification was applied in preparation of cakes. The total procedure is given in Figure-1.

Physico-chemical analysis: Moisture, ash, protein and fat were measured according to standard methods of AOAC[9]. Total carbohydrate was measured by subtracting the measured moisture, ash, protein, fat content from 100. Physical parameters of cake including crust, crumb and porosity were assessed by objective evaluation.

Sensory evaluation: A number of 20 panelists were listed for sensory evaluation of prepared cakes. Prepared cakes were served to the panelists in randomly with coded plates. The test panelists were asked to evaluate each cake for color, flavor, texture and overall acceptability on a 9 point hedonic scale where 1 = dislike extremely to 9 = like extremely[10].

Statistical analysis: The data were statistically analyzed by one way Analysis of Variance (ANOVA) with Completely Randomized Design using SPSS Software (version 20.0). The means were compared using Duncan Multiple Range Test (DMRT) at the 5% significance level.

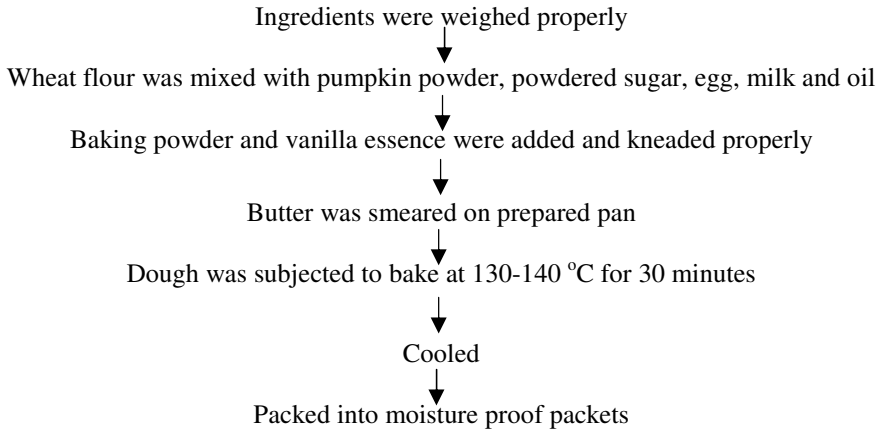

Figure-1
Flow chart for the preparation of cake

Results and Discussion

Proximate compositions of pumpkin powder: Table-2 shows proximate compositions of pumpkin powder. Proximate compositions of pumpkin powder was more or less similar to the findings of See *et al.*[11] who observed less protein content (9.65%) but slightly higher fat content (0.80%) in pumpkin powder. Moisture content was within safety limit because Bothast *et al.*[12] noted that pumpkin powder with more than 14% moisture is susceptible to fungus and mold growth. On the other hand, ash (3.8%) and protein (9.0%) in pumpkin powder were reported by Ptitchkina *et al.*[6].

Table-2
Proximate compositions of pumpkin powder

Composition	Pumpkin Powder
Moisture (%)	10.14±0.12
Ash (%)	5.6±0.09
Protein (%)	11.41±0.17
Fat (%)	0.01±0.10
Total Carbohydrate (%)	72.84±0.11

Mean value ± Standard deviation of three replicates

Proximate compositions of cakes with different levels of pumpkin powder: Results revealed that substitution of pumpkin powder significantly affected the proximate compositions of cake. Moisture content in cake increased with the addition of substituted pumpkin powder. However, the highest moisture content (19.70%) was found in sample D (15% pumpkin powder), whereas the lowest amount (18.23%) was resulted in control. Ash and protein content in cake also increased with the addition of pumpkin powder. Hygroscopic nature of pumpkin powder is one of possible reasons behind the increase in moisture content. This result was in line with Bhat and Bhat[13] who found higher moisture content in cakes with higher amount of pumpkin powder. Similar trend was also reported in banana cake by Eke *et al.*[14] and in pumpkin bread by See *et al.*[11].

The highest ash (1.40%) and protein (14.60%) were observed in sample D (15% pumpkin powder) and the lowest ash (0.68%) and protein (8.70%) were found in control. Higher ash and protein content in pumpkin powder resulted higher ash and protein in pumpkin cakes. Bhat and Bhat[13] also reported higher ash and protein content in cakes with the increase of pumpkin powder. Similar trends in ash and protein content in breads with pumpkin powder were observed by See *et al.*[11]. In this research, fat content and total carbohydrate in cake were found to be decreased with the replacement of flour (Table-3). Control sample contained highest fat content (15.10%) and total carbohydrate (57.09), whereas sample D resulted in lowest fat content (14.87%) and total carbohydrate (50.20%). Low fat and carbohydrate content of pumpkin powder might be possible reason behind the decreasing of fat and carbohydrate content in supplemented cakes.

Physical analysis of prepared cakes: Physical parameters i.e. crumb and crust characteristics of prepared cakes are presented in Table-4. Results indicated that pumpkin powder affected the crumb and crust characteristics of cakes largely. Deep brown and tough crumb in cake was resulted with the highest substitution of wheat flour by pumpkin powder. On the other hand, crust color of cake changed from brown to deep brown with the addition of pumpkin powder. This result was accordance with the result of See *et al.*[11] who noted the change of crust color from light brown for control to darker brown for bread with 15% pumpkin powder. Crust sweetness also found to be increased with the increase of pumpkin powder. Significant change in lumps and hardness among sample A, B and C was not observed in this study. However, light rough surface was resulted in sample D accept sample A, B and C (Table-4).

Table-3
Proximate composition of cake prepared with different levels of pumpkin powder

Sample	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Total Carbohydrate (%)
A	18.23 ± 0.20^{c}	0.68 ± 0.09^{c}	8.70 ± 0.23^{c}	15.10 ± 0.18^{a}	57.09 ± 0.13^{a}
B	18.62 ± 0.17^{b}	1.30 ± 0.10^{b}	9.54 ± 0.13^{b}	15.11 ± 0.20^{a}	57.07 ± 0.16^{a}
C	19.03 ± 0.22^{ab}	1.29 ± 0.11^{b}	14.54 ± 0.21^{a}	15.02 ± 0.13^{ab}	50.72 ± 0.20^{b}
D	19.70 ± 0.15^{a}	1.40 ± 0.13^{a}	14.60 ± 0.14^{a}	14.87 ± 0.17^{b}	50.20 ± 0.28^{b}

Mean value ± Standard deviation of three replicates; mean values with different superscripts in a column are different at $p<0.05$; A=control, B= cake with 5% pumpkin powder, C= cake with 10% pumpkin powder, D=cake with 15% pumpkin powder

Table-4
Crust and crumb characteristics of cakes incorporated with different amount of pumpkin powder

Sample	Crumb Characteristics		Crust Characteristics			
	Color	Consistency	Color	Texture		Flavor
				Lumps and Hardness	Surface	
A	Brown	Slightly tender	Brown	Present slightly	Smooth	Slightly sweet
B	Brown	Slightly tender	Brown	Present slightly	Smooth	Sweet
C	Brown	Slightly tender	Brown	Present slightly	Smooth	Sweet
D	Deep brown	Tough	Deep brown	Present	Light rough	More sweet

See ligand to Table-2 for details

Sensory evaluation: Figure-2 represents the sensory evaluation of cakes with different amounts of pumpkin powder. Addition of pumpkin powder affected the color, flavor, texture, taste and overall acceptability of cakes. Data revealed that highest score for color was found in sample D, whereas control sample (A) was scored with lowest value. In construct, poor textural characteristic of cake was marked with the addition of pumpkin powder. However, sample C (10% pumpkin powder) was most accepted, followed by sample B (5% pumpkin powder) where control and sample D (15% pumpkin powder) were least preferred based on flavor, taste and overall acceptability. The difference in sensory attributes of pumpkin added cakes might be resulted because of stronger odor and flavor of pumpkin powder. See *et al.*[11] also reported significant difference in sensory attributes between 10% and 15% pumpkin powder bread.

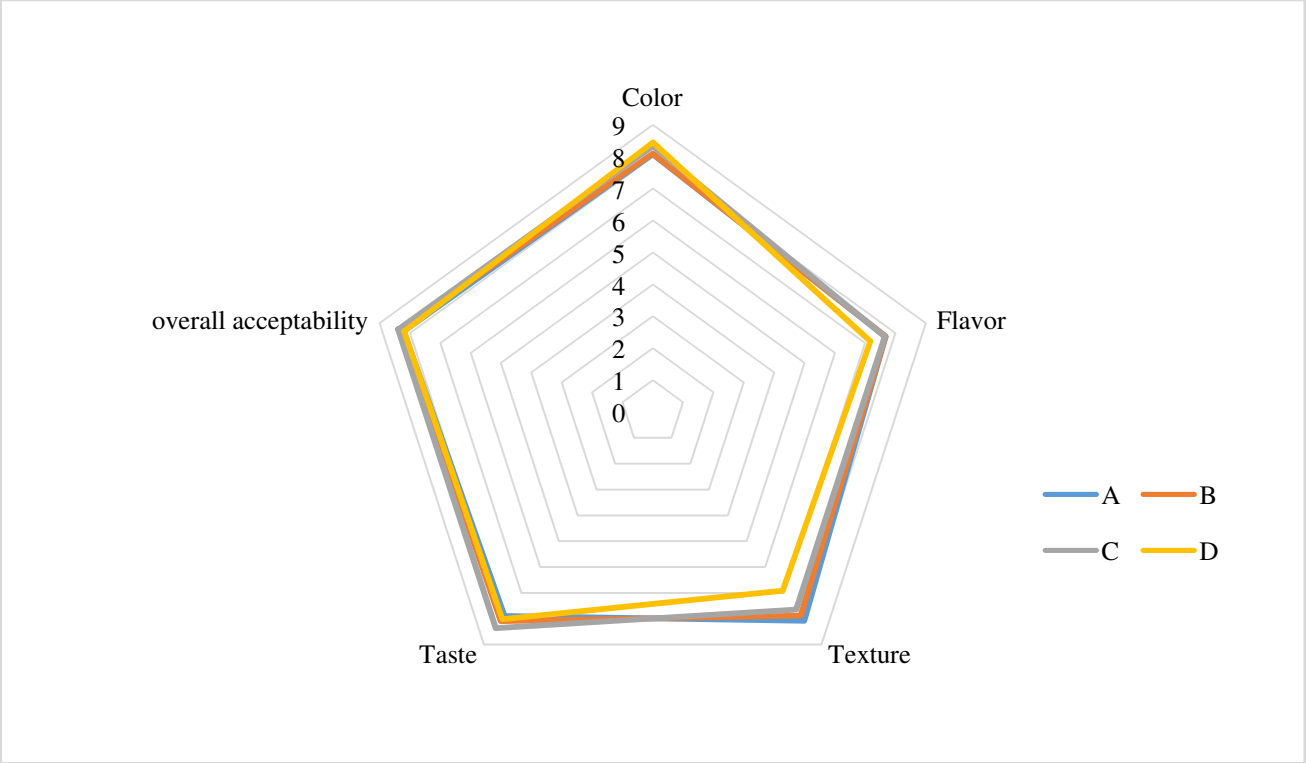

Figure-2
Sensory evaluation of cakes prepared with different levels of pumpkin powder

Conclusion

Consumer's interest in cake consumption has motivated researchers to develop pumpkin powder blended cake in Bangladesh. The change in physico-chemical properties of cake with the supplementation of pumpkin powder was also evaluated in this study. It was clearly observed that addition of more than 10% of pumpkin powder had strong effects on physico-chemical and organoleptic properties of cake. Cake with 10% of pumpkin powder was accepted to the panelists among blended cakes. Hence, pumpkin powder could be successfully added to prepare cake to function as natural nutrient source with remarkable health benefits and increasing consumer acceptance.

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