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Study on Physico-Chemical Characteristics of Pumpkin Blended Cake

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Abstract

In the current study pumpkin blended cakes were prepared by substituting refined and whole wheat flour with pumpkin powder in the ratio's of 100:00, 90:10, 80:20 and 70:30. The highest moisture content (19.87) was recorded in T_4 (70:30: refined wheat flour: pumpkin) while ash (4.15%), crude fiber (1.90%) and β-carotene (0.91 mg /100g) were highest in T_8 (70:30: whole wheat flour: pumpkin). The highest crude protein (14.77%) and crude fat (29.80%) were recorded in T_5 (100:00: whole wheat flour: pumpkin) whereas highest carbohydrate content of 54.52 per cent was recorded in T_1 (100:00: refined wheat flour: pumpkin).

Keywords: Cake; Pumpkin; Pumpkin powder; Physico-chemical parameters

Introduction

The post harvest loss of fresh fruits and vegetables are estimated to be 20-30%. In order to prevent the losses, there is a need to process the commodities into various value added products. India is one of the largest producers of fruits and vegetables in the world and occupies a second position after China. Pumpkin (*Cucurbita moschata*) is one of the important cucurbitaceous vegetable grown all over India. Pumpkins are extensively grown in tropical and sub-tropical countries. Pumpkin is composed of *Cucurbita moschata, Cucurbita pepo, Cucurbita maxima, Cucurbita mixta, Cucurbita facifola and Telfairia occidental* [1]. *Cucurbita moschata, Cucurbita pepo, Cucurbita maxima* are the world wide commonly grown species of pumpkin [2]. These represent economically important species and have high production [1]. The annual production of pumpkin in Jammu and Kashmir and particularly in Jammu region is 4,719 metric tonnes over an area of 23 hectares [3].

Pumpkin also called kashiphal or lal kadu occupies a prominent place among vegetables owing to its high productivity, nutritive value, good storability, long period of availability and better transport qualities. Their colors vary from green, white and blue grey or yellow, orange or red depending on the species. It is used both at mature and immature stages as a vegetable. The flesh is delicious when fried, stewed, boiled or baked. Fresh pumpkins are very perishable and sensitive to microbial spoilage, even at refrigerated conditions. It can be consumed in variety of ways such as fresh or cooked vegetable, as well as being stored frozen or canned [4]. The fruits are sweetish when fully mature and can be used in preparing sweets, candy or fermented into beverages. They are rich in carotenes, minerals, vitamins, pectin and dietary fiber. The yellow-orange characteristic color of pumpkin is due to the presence of careteniods. Its young leaves, tender stem and flowers are also cooked and consumed. Besides, being nutritionally rich the fruit also posses many medicinal properties. They are diuretic, tonic and calm thirst. Careteniods are the primary source of vitamin A for most of the people in the developing countries [5] where vitamin A deficiency is still common [6] (Chakarvarty, 2000). It is believed that β- carotene has a protective role against cancer [7] and coronary heart diseases [8]. The pulp of the fruit is considered as sedative, emollient and refrigerant [9]. In India, these are mostly consumed in fresh vegetable preparations with the exception of their use in vegetable soups where pumpkin is added as thickening agent. Pumpkin has a vast scope for diversification and can be utilized in the production of processed products like jam, pickle, beverage, candy, bakery products and confectionary. Pumpkin can be processed into flour which has a longer shelf-life. Pumpkin flour is used because of its highly-desirable flavor, sweetness and deep yellow-orange color. It has been reported to be used to supplement cereal flours in bakery products like cakes, cookies, bread, for soups, sauces, instant noodle and spice as well as a natural coloring agent in pasta and flour mixes [10]. Bakery products like cakes, cookies, bread etc are very much liked by both young and old generation in rural and urban areas. So, an attempt was made to develop wholesome and nutritious cake by blending whole wheat flour and pumpkin, along with other ingredients. Over consumption of refined products like refined flour is one of the primary causes of diseases, as there is imbalance of minerals. It is therefore vital to consume less processed, more natural and nutritious products such as whole wheat flour.

Material and Methods

Fruit size

The fruit size was measured with help of Vernier's caliper and the average fruit size (length and diameter) was calculated and expressed in centimeters (cm).

Fruit weight

Fruits were selected at random and weighed on top pan balance individually and fruit weight was calculated and expressed in kg.

Moisture content

Moisture content was estimated as per AOAC [11]. 10 g sample was dried in hot air oven at 130°C ± 1°C in pre-weighed dishes till constant weight. The dish with dried sample was transferred to desiccators and cooled to room temperature. The dish was then weighed and moisture content in per cent was calculated from loss in weight.

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$$Percent\ moisture = \frac{Loss\ in\ weight}{Weight\ of\ sample} \times 100$$

β - Carotene

Five gram of sample was taken, crushed in 10-15 ml of acetone with the help of pestle and mortar and few crystals of anhydrous sodium sulphate were added. The supernatant was decanted into a beaker. The process was repeated twice and combined supernatant was transferred to a separating funnel, then 10-15 ml of petroleum ether was added and mixed thoroughly. Two layers separated out on standing. The lower layer was discarded and upper layer was collected in 100 ml volumetric flask. The volume was made to 100 ml with petroleum ether and optical density was recorded at 452 nm using petroleum ether as blank [12]. The β-carotene was calculated using the following formula:

$$\beta - carotene\left(mg/100\ g\right) = \frac{Optical\ density\ of\ sample \times 13.9 \times 10^4 \times 100}{Weight\ of\ sample \times 560 \times 1000}$$

Ash

A known quantity of ground sample was taken in a pre-weighed silica crucible and charred over the heater to make it smoke free. The crucible along with the sample was ignited at 600°C for 3 hrs in muffle furnace. When muffle furnace was slightly cooled, the crucible with ash was taken out, kept in desiccators to cool down, and weighed to a constant weight. The difference between the weight of silica crucible as empty and with ash was the amount of total ash. The per cent ash was calculated from the following formula.

$$Percent\ ash = \frac{Weight\ of\ ash}{Weight\ of\ sample} \times 100$$

Crude fat

Five gm of dried sample was extracted with petroleum ether in Soxhlet extraction apparatus for 6 hr. The ether extract was filtered in pre-weighed beakers, petroleum ether was evaporated completely from the beakers and the increase in weight of beaker represented the fat content [11].

Weight of the sample = W (g)

Weight of the empty beaker = W_1 (g)

Weight of the empty beaker + fat content (ether extract) = W_2 (g)

$$Percent\ fat\ content = \frac{Amount\ of\ the\ ether\ extract\left(g\right)}{Weight\ of\ the\ sample\left(g\right)} \times 100$$

$$= \frac{W_2 - W_1}{W} \times 100$$

Crude fiber

Two g fat free dried sample was transferred to 600 ml beaker and 200 ml of 1.25% H_2SO_4 was added. Beaker was placed on digestion apparatus with readjusted hot plate and boiled for 30 min. Filter the contents through a filter paper. Wash the residue free of acid using hot distilled water and then transferred to the same beaker to which add 200 ml of 1.25% sodium hydroxide. Digest the contents for half an hour, filter and wash free of alkali using hot distilled water. The residue was transferred to crucibles, weighed, dried in an oven overnight at 105°C, and then placed in the muffle-furnace at 600°C for 3 hrs. The loss in weight after ignition represents the crude fiber in the sample [11].

$$Percent\ of\ crude\ fiber = \frac{Loss\ in\ weight}{Weight\ of\ sample} \times 100$$

Carbohydrates

Amount of carbohydrates was calculated from the sum of moisture, crude protein, crude fat, ash and crude fiber and lastly subtracting it from 100 [11].

Crude protein

Crude protein was estimated by using Micro-kjeldahl method, AOAC [11], using the factor 6.25 for converting nitrogen content into crude protein.

Procedure

Weighed sample (1.0g) was digested with concentrated sulphuric acid (20 ml) and digestion mixture (10.0 g) in Kjeldahl digestion flask. The contents were cooled and transferred to 250 ml volumetric flask. The volume was made up to the mark with distilled water and mixed. Measured aliquot (5 ml) was poured in distillation flask followed by 40% sodium hydroxide and ammonium borate was collected through a condenser in a flask containing 10 ml of 4.0% boric acid solution. The distillate was titrated with 0.1 N sulphuric acid. A blank sample was also run along with the samples.

$$Percent\ Nitrogen = \frac{Titre\ value \times 0.0014 \times Volume\ made}{Aliquote\ taken\left(g\right) \times Weight\ of\ sample\left(g\right)} \times 100$$

Crude protein (%) = % Nitrogen x 6.25

Statistical analysis

The results obtained were statistically analyzed using Completely Randomized Design (CRD) and CRD factorial for interpretation of results through analysis of variance.

Preparation of cake blended with pumpkin

The fully ripe fruits of second lot of pumpkin were washed, peeled manually, cut into 2 x 3 inches pieces, soaked in 0.1% citric acid solution for 15 minutes and drained. The pumpkin pieces were chopped, juice was extracted and the residue was transferred to a stainless steel tray and dried at 65°C for 8 hr. The dried pumpkin pieces were ground and shifted through mesh.

The cakes were prepared according to the method described by Ceserani et al. [13]. The wheat flour was substituted with different percentages of pumpkin powder for the preparation of cake. The fat and sugar were creamed together until fluffy (double its size) in a stainless steel bowl followed by addition of skimmed milk. The sieved flour with baking powder and baking soda was folded into the mixture gradually with a metal spoon. When all the mixture flour is mixed, the remaining liquid is added. The batter was then placed in containers lined with paper and was baked in a pre-heated oven at 160°C for 30 minutes. After baking the cakes were cooled and packed air tight in high density polythene (HDPE) and kept in refrigerator for storage (Figures 1 and 2).

Recipe

Ingredients	Quantity
Sugar	100 g
Butter	50 g
Skimmed milk	40 ml

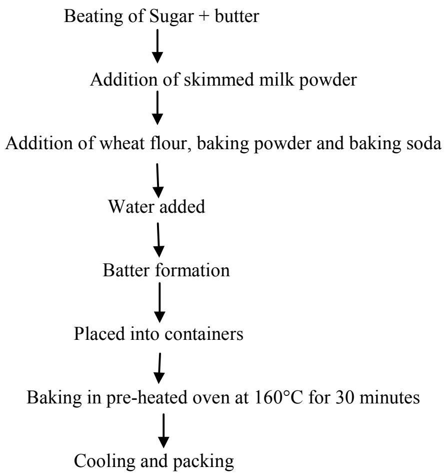

Figure 1: Flow chart for preparation of cake.

(a) (b)

Figure 2: Figure showing (a) Pumpkin powder (b) Pumpkin blended cake.

Baking powder	3 g
Baking soda	2g
Water	100 ml
Wheat flour	100 g

Results and Discussion

Physico-chemical analysis of pumpkin blended cake

Results indicated that fresh pumpkin was significantly higher in moisture and lower in fat, protein, ash and crude fiber content than PF (Table 1).

With the incorporation of pumpkin powder for preparation of cake moisture, crude fiber, ash and β-carotene increased where as crude protein, crude fat and carbohydrate content decreased. Wheat flour has higher protein content (14.27%) than the pumpkin flour (9.65%). During storage moisture and carbohydrate content increased while as crude protein, crude fiber, ash and β-carotene content decreased. The increase in moisture content might be due to hygroscopic nature of pumpkin powder and wheat flour and the higher water absorption capacity in the composite flour compared to wheat flour which was in agreement with the results of Sunday [14]. Similar results were reported by Eke et al. [15] in banana cake, See et al. [16] in bread, Warhadpande et al. [17] in chicken blood plasma incorporated cakes and Rawat et al. [18] in soy fortified chapatti.

The decrease in protein content during storage might be due to hydrolysis of peptide bonds with the help of protease enzyme that cause splitting of protein molecules during storage. Similar decrease of protein content with storage period was reported by Waheed et al. and Pasha et al. [19,20] in cookies. The higher crude fiber was because pumpkin flour contains high insoluble dietary fiber which includes cellulose (40.4g /100g), hemicelluloses (4.3g/100g) and lignin (4.3g/100g) [10]. The decrease in crude fiber might be due to the degradation of hemicelluloses and other structural polysaccharides during storage. Similar decline in crude fiber content was reported by Singh et al. [21] in pearl millet cake. The reduction of fat content might be due to the binding effect of fiber on fat. These findings are in accordance with the findings of Eke et al. [22] in banana cake, Singh et al. [23] in biscuits supplemented with various levels of jiggery and Nwabueze and Atuonwu [24] in African bread fruit seeds incorporated biscuits. The increase in ash content is because of higher ash content in pumpkin powder.

The decrease in carbohydrate content was due to the fact that cake flour was main contributor to the carbohydrate. Similar results were observed by Rasco et al. and Salama et al. [25,26] where sesame flour was added to wheat flour. The decrease in β-carotene might be due to the oxidation. Potter [27] also reported that caroteniods are very sensitive to oxidation which results in loss of color (Tables 2 and 3).

Parameters	**Fresh pumpkin**	**Pumpkin powder**
Moisture content (%)	87.30	6.01
Protein (%)	1.30	3.73
Fat (%)	1.43	1.32
Ash (%)	1.25	7.23
Crude fiber (%)	1.16	2.91
Carbohydrate (%)	10.50	78.73
β-carotene (mg/100 g)	2.44	7.30

Table 1: Physico-chemical composition of fresh fruits of pumpkin and pumpkin powder.

Treatments	**Moisture content (%)**	**Crude protein content (%)**	**Crude fibre content (%)**	**Fat content (%)**
T_1 (100:00 ::refined wheat flour : pumpkin)	19.55	14.64	0.83	29.68
T_2 (90:10 :: refined wheat flour : pumpkin)	19.62	13.73	1.06	29.27
T_3 (80:20 :: refined wheat flour : pumpkin)	19.70	12.84	1.27	28.94
T_4 (70:30 :: refined wheat flour : pumpkin)	19.90	12.05	1.74	28.03
T_5 (100:00 ::whole wheat flour : pumpkin)	19.58	14.70	0.86	29.56
T_6 (90:10 :: whole wheat flour : pumpkin)	19.66	13.80	1.09	29.30
T_7 (80:20 :: whole wheat flour : pumpkin)	19.76	12.91	1.31	28.99
T_8 (70:30 :: whole wheat flour : pumpkin)	19.84	12.12	1.85	28.07

Table 2: Effect of storage on physico-chemical characteristics of pumpkin blended cake during storage period.

Treatments	**Ash content (%)**	**Carbohydrate content (%)**	**β-carotene content (mg /100 g)**
T_1 (100:00 ::refined wheat flour : pumpkin)	**2.74**	**54.71**	**0.16**
T_2 (90:10 :: refined wheat flour : pumpkin)	**3.12**	**53.71**	**0.46**

T_3 (80:20 :: refined wheat flour : pumpkin)	**3.57**	**52.49**	**0.64**
T_4 (70:30 :: refined wheat flour : pumpkin)	**4.01**	**51.52**	**0.88**
T_5 (100:00 ::whole wheat flour : pumpkin)	**2.80**	**54.49**	**0.17**
T_6 (90:10 :: whole wheat flour : pumpkin)	**3.20**	**53.50**	**0.47**
T_7 (80:20 :: whole wheat flour : pumpkin)	**3.63**	**52.27**	**0.67**
T_8 (70:30 :: whole wheat flour : pumpkin)	**4.08**	**51.55**	**0.89**

Table 3: Effect of storage on physico-chemical characteristics of pumpkin blended cake during storage period.

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