DIU Journal of Health and Life Sciences Volume 08, No.01 & 02, 2021
https://doi.org/10.36481/diuhls.v08i1-2.qy68x208

PREPARATION OF PUMPKIN FLOUR FROM *CUCURBITA MOSCHATA* WITH STUDY ON PHYSICO-CHEMICAL CHARACTERISTICS OF CAKE BY UTILIZING PUMPKIN AND WHEAT FLOUR BLENDS

*Effat Ara Jahan, Shohag Hossain

Department of Nutrition and Food Engineering, Faculty of Allied Health Sciences, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka-1216, Bangladesh

Abstract: *In the current study pumpkin flour was prepared from Cucurbita moschata and physichochemical characteristics of cake by utilizing pumpkin and wheat flour blends with the percentage of 5, 10 and 15 were studied. Pumpkin flour was produced from mature pumpkin. The content of moisture was higher (73.37%) in raw pumpkin than in flour but the content of protein (7.62%), fat (1.4%), ash (4.96%), carbohydrate (76.30%) and β carotene (7.5%) was higher in pumpkin flour. It was observed that increasing the percentage of pumpkin flour has a significant effect on the physico-chemical and sensory attributes of cake. The content o+ f moisture, ash and protein were increased whereas fat and carbohydrate decreased with increasing the addition of pumpkin flour was also found. The deep brown color with slightly tough crumb and slightly rough crust was found in 15 % pumpkin blended cake and cake prepared with 10% pumpkin flour were more acceptable among the panelist regarding taste, texture, color and overall acceptability.*

Keywords: *Pumpkin, Pumpkin flour, physicochemical, cake, sensory attributes*

Introduction

Pumpkin (*Cucurbita moschata*) belongs to the Cucurbitaceae family and is a mostly grown vegetable in tropical and subtropical countries. Initially green in hue, pumpkins eventually turn yellow, red, or orange due to the presence of β- carotene. Both the mature and juvenile stages of its development are consumed as vegetables. Even under refrigeration, fresh pumpkins are highly perishable and susceptible to microbial deterioration. It can be taken in a variety of forms, including as a raw or cooked vegetable, frozen or canned food, or both. Whether fried, stewed, boiled, or baked, the flesh is delectable. When fully grown, the fruits have a sweet flavor and can be used to make candy, desserts, or beverages by fermenting them. In Bangladesh, it is typically eaten as freshly cooked, steamed, or processed cuisine, like curry. Although it is almost always grown throughout the year, 90% of Bangladesh's pumpkins are produced from January to June[1,2,3]. It contains a lot of vitamins, minerals, pectin, dietary fiber, carotenoids, and ascorbic acids. Moreover, it is abundant in several phytochemicals and antioxidants [4,]. In addition to its nutritional value, it has certain therapeutic qualities. They serve as diuretics, tonics, and thirst suppressants. Where vitamin A insufficiency is still widespread, carotenoids serve as the main source of vitamin A in developing nations[5,6].

*Corresponding author: Effat Ara Jahan, Lecturer (Senior Scale), Department of Nutrition and Food Engineering, Faculty of Allied Health Sciences, Daffodil International University (DIU), Daffodil Smart City, Birulia, Savar, Dhaka-1216, Bangladesh; E-mail: effatara.nfe@diu.edu.bd

According to some studies, the -carotene found in pumpkins can help prevent some malignancies and cardiovascular disorders [7,8]. The fruit's pulp is reportedly also tested for its potential as a sedative, emollient, and refrigerant[9].

Pumpkin can be used to make a variety of processed goods, including jam, pickles, beverages, candies, baked goods, and confections. It also has a wide range of other uses. Pumpkin may be used to make flour that has a longer shelf life. Because of its incredibly tasty flavor, sweetness, and rich yellow-orange color, pumpkin flour is frequently utilized.

It has reportedly been used as a cereal flour replacement in bakery products including cakes, cookies, and bread, for soups and sauces, instant noodles, and spice blends, as well as a natural coloring ingredient in pasta and flour mixtures [10]. In order to enhance them and add value, bakery and confectionery items have recently been combined with different nutrients. Wheat flour is the fundamental component of baked goods; however, it lacks β- carotene, which can be filled in by using fruits and vegetables as a source[11].

In bakery and confectionery items, pumpkins can be ground into flour and utilized as a rich source of beta-carotene. Moreover, the flour's appealing color, flavor, and sweetness make it a good addition to wheat flour when making pastry goods [10]. In Bangladesh, cake is a very common bakery item that is enjoyed by people of all ages in both urban and rural areas. Bangladesh still has a high prevalence of vitamin A deficiency. Therefore, an effort was made to create a nutritious cake by adding various percentages of pumpkin flour to wheat flour along with other ingredients. The objective of the study was to evaluate the effect of physicochemical properties in wheat flour and pumpkin flour blend cake.

Materials and Methods

Preparation of Pumpkin flour

The fresh, mature pumpkin was collected from Kauranbazar, Dhaka. Then it was peeled, washed and sliced into small pieces followed by boiling at 80 for 10 minutes for blanching. According to Pongjanta et al.,[12] treated slices were then dried at 60 for 8 hours in a cabinet dryer. The dried slices were then ground into flour and stored in vacuum glass jars.

Preparation of pumpkin blended cake

The raw materials of the cake were purchased from a supermarket. The cakes were made according to the methods described by Ceserani et al.[13]. The pumpkin flour blended cakes were prepared by using different levels of pumpkin flour as 5%,10% and 15 % replacing the same percentage of wheat flour and other ingredients were same in all the cakes. The recipe for the cakes is described below in Table-1 and the total procedure is given as a flowchart in figure-1.

Table-1: Recipe of Cake on the basis of 100g flour

Ingredients	Sample A	Sample B	Sample C	Sample D
Wheat flour (g)	100	95	90	85
Pumpkin powder	0	5	10	15
Sugar (g)	75	75	75	75
Egg (no)	2	2	2	2
Baking powder (g)	3	3	3	3
Milk powder (g)	30	30	30	30
Vanila essence (g)	1.5	1.5	1.5	1.5
Oil (ml)	45	45	45	45

A=control, B= cake with 5% pumpkin flour, C= cake with 10% pumpkin flour, D= cake with 15% pumpkin flour

Physicochemical Analysis

According to the association of Official Analytical Chemists (AOAC) procedures[14] moisture, protein, fat, crude fiber and carbohydrate were measured. The content of ash was assessed by using a muffle furnace. The content of β-carotene in the pumpkin flesh and flour was determined by FTIR spectroscopic method[15]. The objective evaluation was used for assessing the physical parameters of the cake including crust and crumb characteristics.

Moisture Content

The moisture content was calculated in accordance with AOAC standards[14]. 5g of sample was dried in a hot air oven at 130°C ± 1°C until consistent weight in pre-weighed dishes. The dish containing the dried specimen was placed in desiccators and chilled to room temperature. The dish was then weighed, and weight loss was used to compute the dish's moisture content in percent.

Protein

$$1:\ \text{Moisture}\ (\%) = \frac{\text{loss of weight}}{\text{Weight of sample}} \times 100$$

The Micro-Kjeldahl technique, AOAC, and the factor 6.25 for converting nitrogen content to crude protein were used to calculate crude protein[14] with the following formula.

$$2:\ \text{Nitrogen}\ (\%) = \frac{\text{Titre value} \times 0.0014 \times \text{volume made}}{\text{Aliquote taken}\ (g) \times \text{weight of sample}\ (g)} \times 100$$

$$\text{Crude protein}\ (\%) = \%\text{of nitrogen} \times 6.25$$

Fat

Five grams of a dried sample extracted with petroleum ether for six hours using Soxhlet equipment. The ether extract was filtered in pre-weighed beakers, petroleum ether was entirely evaporated from the beakers, and the rise in weight of the beakers indicated the fat content [14].

$$3: \text{Fat content (\%)} = \frac{\text{Amount of the ether extarct (g)}}{\text{Weight of the sample (g)}} \times 100$$

Ash

A pre-weighed silica crucible was filled with ground samples and burned over the heater to remove smoke. The muffle furnace ignited the crucible and sample at 600°C for 3 hours. After the muffle furnace cooled, the crucible with ash was removed, cooled in desiccators, and weighed to a constant weight. Total ash weight was the difference between empty and full silica crucible weight.

$$4: \text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Crude Fiber

A Three g fat-free dry sample was added to a 600 ml beaker with 200 ml of 1.25% H2SO4. Beaker was boiled for 30 minutes on digesting apparatus with an adjusted hot plate. After filtration, content, 200 ml of 1.25% sodium hydroxide was added to the same beaker after washing the residue with hot distilled water to remove the acid. After 30 minutes, filter and wash with hot distilled water to remove alkali. The residue was placed in crucibles, weighed, dried overnight at 105°C, and then deposited in the muffle furnace at 600°C for 3 hours. Crude fiber is the sample's weight loss following burning [14].

$$5: \text{Crude fiber (\%)} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100$$

Carbohydrate

Carbohydrate was estimated by subtracting 100 from moisture, crude protein, crude fat, ash, and crude fiber[14].

Sensory Evaluation

The sensory evaluation of prepared cakes was carried out by 30 Trained panelists from Daffodil International University on a nine-point hedonic scale for different sensory parameters such as color, flavor, texture, taste and overall acceptability where 1 = dislike extremely to 9 = like extremely[16].

Statistical Analysis

All the data were analyzed as a completely randomized design procedure using the general linear model

procedure of the SPSS statistical package program (SPSS, Inc., Chicago, IL).

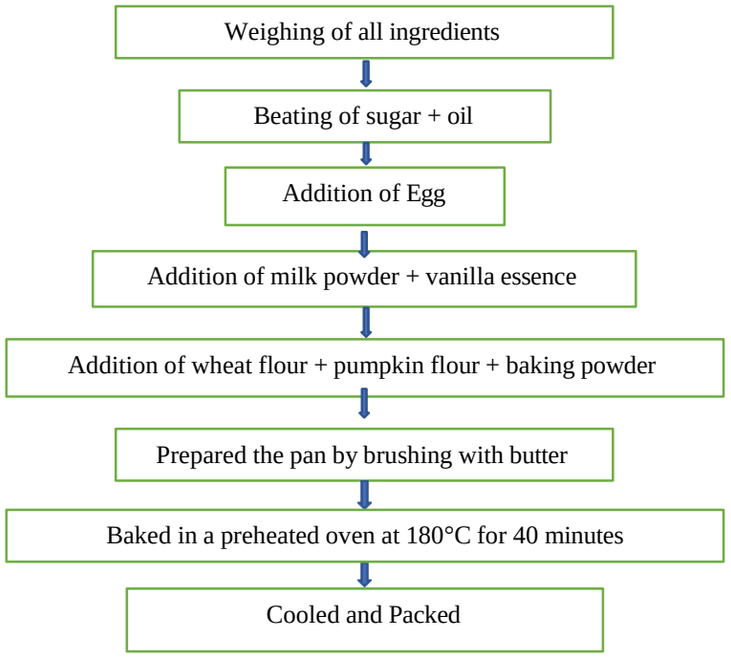

Figure-1: Flow chart for the preparation of cake

Results and Discussion

Physicochemical composition of raw pumpkin and pumpkin powder

Table 2 shows that raw pumpkin is higher in moisture content (73.37%) than pumpkin powder but the content of protein (7.62%), fat (1.4%), carbohydrate (76.30%), ash (4.96%), crude fiber (2.96%) and β carotene (7.5%) is higher in powder than raw pumpkin. According to El-Demery M.E, the content of ash, protein, fat, carbohydrate and fiber was higher and moisture was lower in pumpkin flour than in pumpkin pulp[17].

Table 2: Physicochemical composition of raw pumpkin and pumpkin flour

Parameters	Raw pumpkin	Pumpkin flour
Moisture (%)	73.37	6.75
Protein (%)	4.75	7.62
Fat (%)	1.16	1.40
Ash (%)	0.74	4.96
Crude fiber (%)	1.26	2.96
Carbohydrate	18.715	76.30
P^H	6.35	6.15
β carotene mg/100gm	2.5	7.5

Proximate analysis of cake prepared with different levels of pumpkin flour

Table 3 shows that the replacement of refined wheat flour with pumpkin flour effect the proximate analysis of cake. The result of the cakes showed that moisture content increased with increasing the percentage of pumpkin flour. The highest content of moisture (19.88%) was found in sample D whereas the lowest (18.03%) was recorded in the control. With the addition of pumpkin flour, the content of ash and protein was also increased. Bhat and Bhat[18] also found higher content of moisture in cake with the addition of pumpkin powder. See et al.[18] also showed the same thing in pumpkin bread. The highest content of protein (10.09%) and ash (1.7%) was observed in sample D compared to the lowest in Control as protein (6.5%) and ash (0.7%). It is reported that Bhat and Bhat[18] also found higher protein and ash content in cake with the increasing of pumpkin flour. See et al.[19] also observed a similar thing in bread prepared with the addition of pumpkin flour. It is also found that the content of fat and carbohydrate decreased with the increasing percentage of pumpkin flour. The highest fat (14.10%) and carbohydrate (60.67%) in control compared to the lowest fat (13.56%) and carbohydrate (54.77%) in sample D.

Table 3: Proximate analysis of cake prepared with different levels of pumpkin flour

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
A	18.03±19	6.5±0.24	14.10±17	0.70±0.08	60.67±0.14
B	18.23±16	8.7±12	14.11±19	1.30±0.09	57.66±0.17
C	19.62±23	9.54±22	14.02±12	1.50±0.10	55.32±0.21
D	19.88±20	10.09±13	13.56±16	1.70±0.12	54.77±0.27

Mean value ± Standard deviation of four samples;
A=control, B= cake with 5% pumpkin flour, C= cake with 10% pumpkin flour, D=cake with 15% pumpkin flour

Physical Analysis of Pumpkin flour blended cakes

Table 4 shows the result of the physical analysis of crust and crumb characteristics of pumpkin flour blended cakes. It was found that the increasing percentage of pumpkin flour had a strong effect on crumb color and consistency whereas affect the texture and flavor of the crust. It was also observed that the deep brown color of the crumb and slightly rough texture and sweeter flavor was found in sample D (15% pumpkin flour). See et al.[19] also found similar changes in bread blended with 15 % pumpkin flour.

Table 4: Crust and crumb characteristics of Pumpkin flour blended cakes

Samples	Crumb characteristics		Crust characteristics	
	color	consistency	Texture	Flavor
A	Brown	Slightly tender	Smooth	Slightly sweet
B	Brown	Slightly tender	Smooth	Sweet
C	Brown	Tender	Smooth	Sweeter
D	Deep Brown	Slightly Tough	slightly rough	More Sweet

Sensory Analysis of cakes blended with different levels of pumpkin flour

Figure 2 revealed the sensory analysis of cakes blended with different levels of pumpkin flour. It was observed that the replacement of wheat flour with pumpkin flour in cake affected the overall acceptance, taste, texture, flavor and color. The data showed that the highest score for color was observed in sample D whereas the lowest color was observed in control sample A. It was also found that sample C with 10% pumpkin flour showed the most positive response compare to sample B with 5 % flour and Sample D with 15% pumpkin flour based on texture, taste and overall acceptability. See et al[19] also found a significant difference in sensory attributes between blended with 10% and 15% pumpkin flour bread.

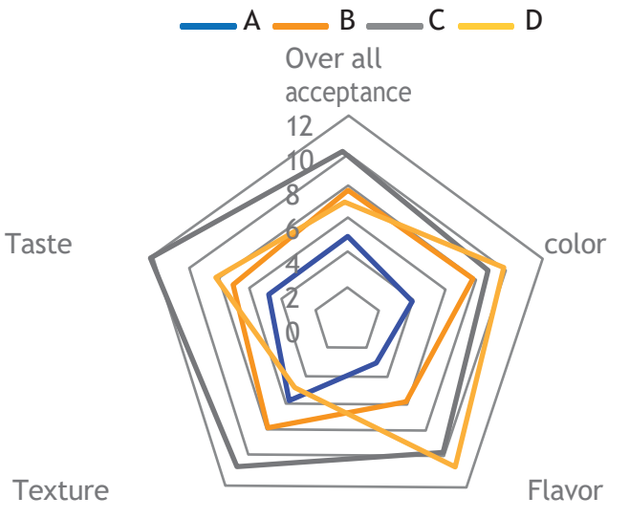

Figure-2: Sensory Analysis of cakes blended with different levels of pumpkin flour

Conclusion

The cake is a very popular baked item among all generations of Bangladesh. This study revealed that pumpkin flour added nutritious value to the cake as it was rich in β carotene. It also revealed that the physicochemical properties had been changed with the increasing percentage of pumpkin flour in the cake. Cake prepared with 10% pumpkin flour had a strong effect on physicochemical properties showed a positive response in all sensory attributes and was accepted by the panelist among all the blended cakes. Hereafter, pumpkin flour can be used in pssssreparing a cake as a natural source of nutrients with remarkable health benefits.

References

1. *Kandlakunta B, Rajendran A, Thingnganing L. Carotene content of some common (cereals, pulses, vegetables, spices and condiments) and unconventional sources of plant origin. Food Chemistry. 2008 Jan 1;106(1):85-9. https:// doi.org/10.1016/j.foodchem.2007.05.071.*
2. *BBS. Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics, Statistic Division, Ministry of Planning, Govt. of the people's Republic of Bangladesh, Dhaka;2008.*
3. *Figueredo E, Cuesta-Herranz J, Minguez A, Vidarte L, Pastor C, de las Heras M, Vivanco F, Lahoz C. Allergy to pumpkin and cross-reactivity to other Cucurbitaceae fruits. Journal of allergy and clinical immunology. 2000 Aug 1;106(2):402-3. https://doi.org/10.1067/mai.2000.108109.*
4. *Jun HI, Lee CH, Song GS, Kim YS. Characterization of the pectic polysaccharides from pumpkin peel. LWT-Food Science and Technology. 2006 Jun 1;39(5):554-61. https://doi.org/10.1016/j.lwt.2005.03.004.*
5. *Boileau TWM, Moore AC, Erdnman JW. Caroteniods and Vitamin A. In: Antioxidant status, diet, nutrition and health , Papas A.M. (eds., 133-138). CRC Press; 1999.*
6. *Chakravarty I. Food-based strategies to control vitamin A deficiency. Food and Nutrition Bulletin. 2000;21(2):135-43. https://doi.org/10.1177/156482650002100205.*
7. *Halter SA. Vitamin A: its role in the chemoprevention and chemotherapy of cancer. Human pathology. 1989 Mar 1;20(3):205-9.. https://doi.org/10.1016/0046-8177(89)90124-x*
8. *Fuller CJ, Faulkner H, Bendich A, Parker RS, Roe DA. Effect of β-carotene supplementation on photosuppression of delayed-type hypersensitivity in normal young men. The American journal of clinical nutrition. 1992 Oct 1;56(4):684-90.*
9. *Kiritikar KR, Basu BD. Indian medicinal Plants. Bishen Singh and Mahendra Pal Singh Publishers; 1975.*
10. *Ptitchkina NM, Novokreschonova LV, Piskunova GV, Morris ER. Large enhancements in loaf volume and organoleptic acceptability of wheat bread by small additions of pumpkin powder: possible role of acetylated pectin in stabilising gas-cell structure. Food Hydrocolloids. 1998 Jul 1;12(3):333-7. https://doi.org/10.1016/s0268-005x(98)00024-1*
11. *Olson JA. Provitamin A function of carotenoids: the conversion of β-carotene into vitamin A. The Journal of nutrition. 1989 Jan 1;119(1):105-8. https://doi.org/10.1093/jn/119.1.105*
12. *Pongjanta J, Naulbunrang A, Kawngdang S, Manon T, Thepjaikat T. Utilization of pumpkin powder in bakery products. Songklanakarin Journal of Science and Technology. 2006 Mar;28(1):71-9.*
13. *Cesarani V, Kinton R. Practical cookery, 8th ed. Hodder and Stonghton, London; 1995.*
14. *AOAC. Official Methods of Analysis (17th edition). Association of Official Analytical Chemists, Arlington, VA. 2000.*
15. *Srivastava RP, Kumar S (2002) Fruit and Vegetable Preservation: Principles and Practices. Motilal Banarsidass Publishers (Pvt. Limited), New Delhi, India.*
16. *Snedecor GW, Corchran R, Press C. Statistical Methods (6th edition). Iowa State University Press; 1976.*
17. *El-Demery ME. Evaluation of physico-chemical properties of toast breads fortified with pumpkin (Cucurbita moschata)*

flour. InThe 6th Arab and 3rd International Annual Scientific Conference on Development of Higher Specific Education Programs in Egypt and the Arab World in the Light of Knowledge Era Requirements, Faculty of Specific Education, Mansoura University, Mansoura, Egypt 2011 Apr 13 (Vol. 1, pp. 13-14).

18. *Bhat MA, Bhat A. Study on physico-chemical characteristics of pumpkin blended cake. Journal of Food Processing & Technology. 2013;4(9):4-9. https://doi.org/10.4172/2157-7110.1000262.*

19. *See EF, Wan Nadiah WA, Noor Aziah AA. Physico-chemical and sensory evaluation of breads supplemented with pumpkin flour. International Food Research Journal. 2007;14(2).*