**Effects of storage on the crude fiber, β-Carotene and Iron Content of Cookies made with wheat flour, pumpkin flour, and pumpkin seeds flour blends**

**Abstract:**

The present study aimed to determine the effects of storage on the crude fiber, β-Carotene and Iron Content of Cookies made with wheat flour, pumpkin flour, and pumpkin seeds flour blends. Consumers believe that foods contribute directly to their health. Today foods are not intended to only satisfy hunger and to provide mandatory nutrients for humans but also to retain nutrition-related diseases and improve physical and mental well-being. Experiments were conducted to development, quality evaluation and storage stability of cookies made from wheat flour, pumpkin flour and pumpkin seed flour. The cookies were formulated by taking different proportion of flours in the ratio of (T100) 100:0:0, (T1) 90:7.5:2.5, (T2) 80:15:5, (T3) 70:20:10 and (T4) 60:25:15 respectively. Wheat flour of the ratio of 100:0:0:0:0 was considered as control. All the samples were packedin high density polyethylene (HDPE) and stored at room temperature from 0 to 120 days for quality evaluation. After preparation of cookies various chemical and nutritional properties were determined, i.e., crude fiber, β-carotene and iron content during storage.

**Keywords:** Wheat flour, pumpkin flour, pumpkin seed flour, and HDPE.

**1. INTRODUCTION**

“Food gives nutrition and energy besides satisfaction and improvement in physical and mental development to grow the humans. In the last ten years consumer demands in the field of food production have changed considerably. Consumers believe that foods contribute directly to their health. Today foods are not intended to only satisfy hunger and to provide mandatory nutrients for humans but also to retain nutrition-related diseases and improve physical and mental well-being” **(Takachi*et al.*, 2008). “**Pumpkins (*Cucurbita moschata*) are extensively grown in tropical and subtropical countries where it traditionally consumed as freshly boiled and steamed or as a processed food items such as soup or curry. Pumpkin is high in β-carotene, which gives its yellow or orange color” **(Bhaskarachary*et al*., 2008)**. “β-carotene in plants that have pleasant yellow-orange color is a major source of vitamin A” **(Lee, 1983; Das and Banerjee, 2013). “**Utilization of foods containing carotene helps in retention of eye disorders, cancer and skin diseases. The base material used for the preparation of bakery and confectionary products is wheat flour. Wheat flour contains a slight amount of β-carotene which is precursor of vitamin A, available in variety of fruits and vegetables” **(Tee and Lim, 1991; Olson, 1989).** “Pumpkin powder can be use as the concentrated source of β-carotene in bakery and confectionary products. Pumpkin flour also rich in various phytochemical and can be used due to its flavor, sweetness, deep yellow-orange color and significant amount of dietary fiber.Pumpkin can be refined in to flour which has a longer shelf life. It has been described to be an addition to cereal flours in bakery products” **(Mervet Ebrahim El- Demery, 2011)**. Pumpkin flour is presently the main processed product from pumpkin fruit because it can be simply stored for a long time and easily used in the manufacturing of formulated foods. The incorporation of pumpkin flour enhances nutrient content of several food products and upgrade their flavour **(Judita *et al*., 2014)**.

“Pumpkin seeds are also a superior source of fibre. They contain 31.48% crude fibre” **(Nyam *et al*., 2013).** “Fibre in pumpkin seeds can stop constipation, diabetes, prolong intestinal transit time, lower cholesterol level, and give satiety. Pumpkin seeds flour is a valuable by-product obtained after the removal of oil from pumpkin seeds. It is rich in fibre and helpful in maintaining intestinal role and gives satiety that is advantageous for fatty people to control the body weight. Another advantage of pumpkin seeds flour is that it is gluten-free, thus a good recommendation to patients suffering from gluten intolerance or celiac disease” **(Patel, 2013)**.

“Cookies are snacks for people of all age categories. Cookies are small, flat, baked treat, normally holding fat, flour, eggs and sugar. The major difference of the pumpkin cookies is lessening quantity of liquid used in the dough preparation” **(Shakuntala and Shadaksharaswamy, 2007;** **Sunil et al. 2022)**.

**2. MATERIALS AND METHODS**

**2.1 Raw Materials**

The ripe pumpkins were procured from the local Subzi Mandi, Meerut for the present studies. The other material viz. milk powder, sugar and HDPE bags etc. were procured from the local market of district Meerut, Uttar Pradesh (India).

**2.2 Experimental Procedure**

The present study was based on the development and evaluation of value added cookies with partial replacement of wheat flour by pumpkin flour and their seed flour. The study was divided into various experiments and as well as different treatments.

 Methodology for sample preparation, methodology preparation of wheat flour, pumpkin flour, pumpkin seed flour and value added cookies and their quality evaluation are described under the following sections. Their detailed methodologies for development of individual flour are given below:

**2.3 Wheat Flour**

Wheat flour was procured from the local market of district Meerut, Uttar Pradesh and mixed the other flour for make ready of various proportion.

**2.4 Preparation of Pumpkin Flour**

Ripe pumpkins were washed and cut into halves parts. After removing the seeds and fluffy portion, pumpkin was cut into slices with the help of sharp knife. The slices were peeled and cutting into shreds. The shreds were blanched for 3-4 minutes followed by dipping in 500ppm of potassium metabisulphite (KMS) solution for 10-15 minutes. After blanching the water was drain out from the bowl. The shreds were then dried in a tray dryer at 60oC for 14-16 hours. The dried shreds were grind using a grinder followed by sieving by a 48 mesh sieve to flour. The pumpkin flour was packed in high density polyethylene (HDPE) bags for use in the preparation of cookies.

**2.5 Preparation of Pumpkin Seed Flour**

Ripe pumpkin was cut into halves and seeds were removed from the fluffy portion. The seeds were washed and manually decorticated. The seeds were dried and after that seeds were crushed by using a grinder. Then the crushed seeds were dried at room temperature and sieving. The flour was packed in high density polyethylene bags and stored at room temperature for further use in preparation of cookies.

Flours comprising wheat flour, pumpkin flour and pumpkin seed flour were used for the present study. The cookies were formulated using variousproportions of flours and other ingredients. All the experiments were conducted in food analysis laboratory and bakery laboratory in the Department of Agricultural Engineering, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India. Cookies were packaged in HDPE at room temperature and analyze the chemical and nutritional characteristics like crude fiber, β-carotene and iron content. The chemical and nutritional characteristics were done as fresh and as well as during storage for 120 days.

**Development of cookies**

**Treatments**

 **T0** - Cookies made by 100% wheat flour

**T1** - 90g wheat flour, 7.5g pumpkin flour and 2.5g pumpkin seed flour

**T2** - 80g wheat flour, 15g pumpkin flour and 5g pumpkin seed flour

 **T3** -70g wheat flour, 20g pumpkin flour and 10g pumpkin seed flour

**T4** - 60g wheat flour, 25g pumpkin flour and 15g pumpkin seed flour

**List 1: Ingredients** of **cookies**

|  |  |
| --- | --- |
| Sugar | 50g/100 g |
| Edible vegetable oil | 40g/100 g |
| Baking Powder | 1.0g/100g |
| Milk powder | 10g/100g |

Cookies were prepared by incorporating different levels of flours viz., wheat flour, pumpkin flour and pumpkin seed flourblends in ratio of (T100) 100:0:0, (T1) 90:7.5:2.5, (T2) 80:15:5, (T3) 70:20:10 and (T4) 60:25:15 respectively. All the materials were mixed by hand until firm dough was formed. The dough was rolled out in a baking tray and cut into round in shape with a mould. The cookies were placed in greased aluminum trays and baked in deck oven at 180ºc temperature for 15 minutes. After bakedthe cookies were taken out of deck ovenand cooled at roomtemperature. At last, the cooled cookies were packed into HDPE bags and stored at room temperature for further analysis.

**Estimation of Crude fiber, β-carotene and iron content characteristics of cookies**

Crude fiber, β-carotene and iron content were determined in all the ratio of cookies.

**Crude fiber**

Crude fiber was estimated by employing standard method of analysis **(AOAC, 2012).**

Crude fiber (%) = $\frac{(W1- W2)X100}{W} $

Weight of crude fiber in the sample = Weight of acid and alkali digested residue minus weight of the ash = W1 – W2

Weight of the sample taken for ether extraction = W = ---- g

**Determination of β-carotene (AOAC, 2012)**

**Calculation**

$$Concentration \left(\frac{mg}{l}\right)=\frac{\left(a-b\right)×v}{m}$$

a = Concentration in test sample solutions (mg/kg) from the graph

b= Concentration in blank solution (mg/kg) from the graph

v= Final volume make up

m= Weight in gm. of test sample

* If test solution is diluted, dilution component has to be get hold of in account
* When running replicates, the average of the results must be specified with 2 significant figures
* If concentration is in µg/kg then divide with a factor of 1000

**Determination of iron content**

**Apparatus:** Atomic Absorption Spectrophotometer

Reagents:

(a) Water – redistilled or deionised

(b) Hydrochloric acid A.R (6N) – Dilute 500mL HCl to 1 litre with water

(c) Nitric Acid A.R 0.1M – dilute 7mL conc. acid to 1 litre

(d) Nitric acid concentrated (Sp. Gravity 1.40)

**3. RESULT AND DISCUSSIONS**

The studies were conducted on development and qualityevaluation of cookies by incorporating variousproportions of flours. e.g., wheat flour, pumpkin flour and pumpkin seed flour. The qualities of the fresh and stored cookies were evaluated crude fiber, β-carotene and iron content.

**1. Effect on crude fiber**

The data for variation in crude fiber (%) of cookies during storage is shown in figure 1. The crude fiber of freshly prepared cookies were observed for cookies T0 (0.72%), T1 (0.84%), T2 (0.96%), T3 (1.12%) and T4 (1.28%) respectively. Highest crude fiber observed in T4 cookies as compared to other during storage. Whereas, T0 cookies reported lowest crude fiber content. The results revealed that the crude fiber content of cookies increased with increase in the incorporation of pumpkin flour and pumpkin seed flour in wheat flour.

The crude fiber was observed for T0 cookies (0.72 – 0.63%) followed by T1 (0.84 – 0.75%), T2 (0.96 – 0.87%), T3 (1.12 – 1.03%) and T4 (1.28 – 1.19%) up to 120 days of storage periods. The study revealed that crude fiber content gradually decreased as storage period increased up to 120 days at room condition. The crude fiber of cookies incorporated pumpkin flour and pumpkin seed flour with wheat flour was observed higher as compared to control cookies. Similar trends were found by **Stojceska *et al*., (2008)** cereals based ready-to-eat expanded snacks.

**Fig.1. Effect on crude fiber (%) of cookies during storage period**s

**2. Effect on β-Carotene**

The data for variation in β-carotene (%) of cookies during storage is shown in figure 2. The β-carotene of freshly prepared cookies were observed for cookies T0 (2.06%), T1 (3.78%), T2 (3.86%), T3 (3.89%) and T4 (3.97%) respectively. Highest β-carotene observed in T4 cookies as compared to other during storage. Whereas, T0 cookies reported lowest β-carotene. The results revealed that the β-carotene of cookies increased with increase in the incorporation of pumpkin flour and pumpkin seed flour in wheat flour. The β-carotene was observed for T0 cookies (2.06 – 1.97%) followed by T1 (3.78 – 3.59%), T2 (3.86 – 3.68%), T3 (3.89 – 3.79%) and T4 (3.97 – 3.88%) up to 120 days of storage periods. The study revealed that β-carotene content gradually decreased as storage periods increased at room condition. The β-carotene of cookies incorporated pumpkin flour and pumpkin seed flour with wheat flour was observed higher as compared to control cookies. Similar trends were found by **Anonymous (2012).**

**Fig.2 Effect on β- carotene (%) of cookies during storage period**s

**3.Effect on Iron Content**

The data for variation in iron content (mg) of cookies during storage is shown in figure 3. The iron content of freshly prepared cookies were observed for cookies T0 (17.48 mg), T1 (17.76 mg), T2 (18.03 mg), T3 (19.57 mg) and T4 (19.85 mg) respectively. Highest iron contentobserved in T4 cookies as compared to other during storage. Whereas, T0 cookies reported lowest iron content. The results revealed that the iron content of cookies increased with increase in the incorporation of pumpkin flour and pumpkin seed flour in wheat flour. The iron content was observed for T0 cookies (17.48 – 17.34 mg) followed by T1 (17.76 – 17.67 mg), T2 (18.03 – 17.92 mg), T3 (19.57 – 19.40 mg) and T4 (19.85 – 19.73 mg) up to 120 days of storage periods. The study revealed that iron content gradually decreased as increased in storage period at room condition. The iron content of cookies incorporated pumpkin flour and pumpkin seed flour with wheat flour was observed higher as compared to control cookies. Similar trends were found by **Kanwal *et al*., (2015)**.

**Fig.3 Effect on iron content (mg/100g) of cookies during storage period**s

**CONCLUSION**

Incorporation of pumpkin flour and pumpkin seed flour into wheat flour for the development of cookies is possible based on the chemical and nutritional properties of the cookies. The results revealed that the incorporated cookies had the highest chemical and nutritional properties during the storage compared to control cookies. Therefore, the treatment (T4) has highest chemical and nutritional properties for 120 days stored at room temperature.

The results of this study indicate that storage conditions significantly affect the nutritional content of cookies, particularly crude fiber, β-carotene, and iron content.

**REFERENCES**

**Anonymous, (2012).** Nutritional value of pumpkin seeds. http://www.nutrition- and-you.com/pumpkin-seeds.html (Accession date: 10.7.12).

**AOAC. (2012).** Association of Analytical Communities. 999.11.

**Bhaskarachary, K., Ananthan, R. and Longvah, T. (2008).** Carotene content of some common (cereals, pulses, vegetables, spices and condiments) and unconventional sources of plant origin. *Food Chemistry* 106: 85-89.

**Das, S. and Banerjee, S. (2013).** Production of Pumpkin Powder and Its Utilization in Bakery Products Development: A Review. IJRET: *International Journal of Research in Engineering and Technology* eISSN: 2319-1163 | pISSN: 2321-7308

**Judita, C., Jurgita, K., Honorata, D., Elvyra, J. and Edita, J. (2014).** Pumpkin Fruit Flour as a Source for Food Enrichment in Dietary Fiber. *Notulae Botanicae Horti. Agro botanic*i Cluj Napoca, 42 (1): 19-23.

**Kanwal, S., Raza, S., Naseem, K., Amjad, M., Naseem, B. and Gillani, M. (2015).** Development, physico-chemical and sensory properties of biscuits supplemented with pumpkin seeds to combat malnutrition in Pakistan. *Pakistan J. Agric. Res*. 28: 400-405.

**Lee, F.A. (1983)**. Basic Food Chemistry.AVI Publisher, Westport.

**Mervet Ebrahim and EI-Demery (2011).** Evaluation of physico-chemical properties of toast breads fortified with pumpkin (*Cucurbita Moschata*) flour. *Faculty of specific Education Mansoura University-Egypt* 1432.

**Nyam, K.L., Lau, M. and Tan, C.P. (2013).**Fibre from pumpkin (*Cucurbita pepo L*.) seeds and rinds: Physico-chemical properties, antioxidant capacity and application as bakery product ingredients. *Mal. J. Nutr*. 19: 99-109.

**Olson, J.A. (1989).** Pro-vitamin A function of carotenoids: the conservation of β-carotene into vitamin A. *Journal of Nutrition* 119: 105-108.

**Patel, S. (2013).** Pumpkin (*Cucurbita spp*.) seeds as neutraceutic: A review on status quo and scopes. *Mediterr J. Metab*; 6: 183-89.

**Shakuntala, M.N. and Shadaksharaswamy, M. (2007).** Foods fact and principles. *A text book of Food Science and Technology*, Second Edition. Pp. 487-488.

**Stojceska, V., Ainsworth, P., Plunkett, A., Ibanoglu, E. and Ibanoglu, S. (2008).**Cauliflower by product as a new source dietary fiber, antioxidants and proteins in cereal based ready- to-eat expanded snacks. *J. food Eng*. 87:554-563.

**Takachi, R., Manami, I., Junko, I., Norie, K., Motoki, I. and Shizuka, S. (2008)**. Fruit and vegetable intake and risk of total cancer and cardiovascular diseases Japan public health center-based prospective study. *American Journal of Epidemiology*, 167(1): 59-70.

**Tee, E.S. and Lim, C.L. (1991)**. Carotenoids composition and content of Malaysian vegetables and fruits by AOAC and HPLC methods. *Food Chemistry* 41, 309-339.

Sunil, N. C., Chaudhary, V., Singh, S., & Singh, B. R. (2022). Effect on Physico-chemical properties of cookies during storage. *The Pharm Innov J*, *11*(1), 1046-1048.