**Effect on Crude Fiber, β-Carotene and Iron Content of Cookies during Storage**

**Abstract:**

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 packed in 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 i.e. wheat flour contains a slight amount of β-carotene which is considered as precursor of vitamin A which is 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 which are very nutritious to us. This flour can be used due to its flavor, sweetness, deep yellow-orange color and significant amount of dietary fiber.

Pumpkin can be clarified in to flour which has a longer shelf life. Pumpkin flour is used because of its highly advisable flavour, sweetness and deep yellow colour. It has been described to be used to addition 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 attending in pumpkin seeds can stop constipation, diabetes, prolong intestinal transit time, lower cholesterol level and give satiety. Pumpkin seed flour is a valuable by-product gets after the removal of oil from pumpkin seed that 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, so it can be suggest to the patients suffering from gluten intolerance or celiac disease **(Patel, 2013)**.

Cookies are examined as snacks for people of all age categories. They must be allowable to masses other than having high nutritional quality. 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)**.

**2. MATERIALS AND METHODS**

The experiments were conducted to develop cookies and it does evaluate the chemical and nutritional quality during storage. Flours comprising wheat flour, pumpkin flour and pumpkin seed flour were used for the present study. The cookies were formulated using various proportions of flours and other ingredients. All the experiments were conducted in food analysis laboratory and bakery laboratory in the Department of Agricultural Engineering. 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**

Cookies were prepared by incorporating different levels of flours viz., wheat flour, pumpkin flour and pumpkin seed flour blends 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 optimum time and temperature. After baked the cookies were taken out of deck oven and cooled at room temperature. 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, 1990).**

Crude fiber (%) = $\frac{dried weight- ashed weight}{weight of sample} X 100$

**Determination of Minerals (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

**3. RESULT AND DISCUSSIONS**

The studies were conducted on development and quality evaluation of cookies by incorporating various proportions of flours. e.g., wheat flour, pumpkin flour and pumpkin seed flour. The qualities of the fresh and stored cookies were evaluated on the basis of chemical and nutritional characteristics like 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 increased up to 120 days storage periods under 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 1. The β-caroteneof 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-carotenewas 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-carotenecontent gradually decreased as increased up to 120 days storage periods under room condition. The β-caroteneof cookies incorporated pumpkin flour and pumpkin seed flour with wheat flour was observed higher as compared to control cookies.

**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 content observed 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 under 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.

**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.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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