Research Article

Formulation and Nutritional Evaluation of Cookies Supplemented With Pumpkin Seed (*Cucurbita Moschata*) Flour

Manpreet Kaur* and Sonika Sharma

Department of Food and Nutrition, Punjab Agricultural University, Ludhiana-141001, Punjab, India

Abstract

Numerous ways or ideas of intensifying the use of available local food are increasingly pursued but information of the nutritive value of such local foodstuffs is crucial in order to encourage the consumption to eradicate malnutrition. The purpose of the study was to incorporate pumpkin seeds which are commonly discarded as waste to produce functional food. Pumpkin seeds were processed into raw and roasted flour. Functional food namely cookies were developed by supplementing raw and roasted pumpkin seed flour. One control and six experimental samples were prepared. Organoleptic evaluation was done by a panel of 10 judges. Cookies supplemented with 30% pumpkin seed flour whether in raw or roasted form were highly accepted. Moisture content was higher in control cookies i.e. 8.77%, protein and fat content was maximum in cookies supplemented with roasted pumpkin seed flour i.e. 8.29% and 28.97%, fiber and ash content of cookies supplemented with raw pumpkin seed flour was higher i.e. 2.50 and 2.52%. Iron, zinc and total carotenoid content was higher in cookies supplemented with raw pumpkin seed flour i.e. 2.36, 1.28 and 0.231mg/100gm. Maximum antioxidant activity was also observed in cookies supplemented with raw pumpkin seed flour (58.10%). Peroxide value was higher in control cookies (3.7 meq/kg).

Keywords: Cookies, functional food, nutritive value, organoleptic evaluation, pumpkin seeds

***Correspondence**

Author: Manpreet Kaur

manatwalpau@gmail.com

Introduction

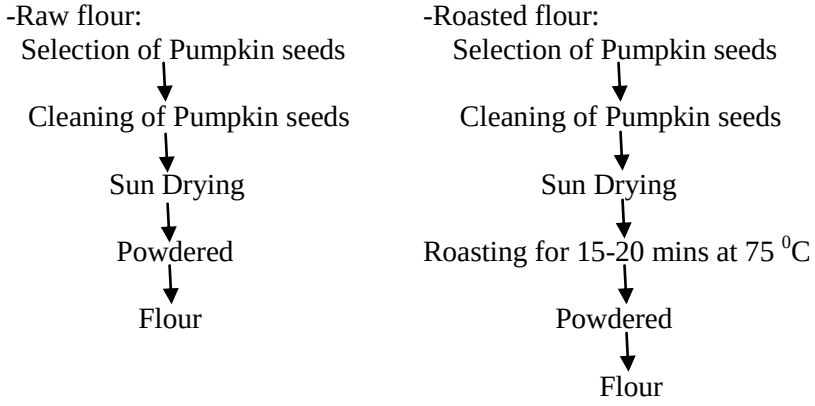
The enrichment of food products is a consequential idea to treat explicit nutritional insufficiencies. Food enrichment also elevates healthiness in humanity and avert chronic diseases. The identification and evolution of fortifying agents that would guarantee good product quality and maximize the bioavailability of essential nutrients create technical and scientific challenges for the nutritionists [1]. Significant consideration has been given to enrich wheat flour products with high protein oilseed flour and for this, baked products are considered best due to worldwide consumption [2]. Pumpkin belongs to the family *Cucurbitaceae.* It is a plant that has been traditionally used as a medicine in developing countries and obtained revival of use in the United States and Europe [3]. Edible parts of the plant include the flowers, fruit, leaves, root and seeds. Pumpkin seeds are loaded with nutrients and medicinal properties due to which these seeds are used for remedial purposes all over the world. Pumpkin seeds are often eaten as snack after roasting and salting in Arab countries [4]. The addition of these seeds can be considered a good substitute for nutritional enhancement of food products [5]. Pumpkin seeds are rich natural source of protein with the range of 25 to 37% and oil with the range of 37 to 45% and are renowned as valuable oil seeds loaded with protein for human consumption [6]. These seeds are also a good source of fiber. They contain 31.48 % crude fiber [7]. Moreover, pumpkin seeds are loaded with amino acids like tryptophan, lysine, methionine, tyrosine and also rich in iron, therefore these seeds are beneficial to adolescents to cure anaemia caused due to iron deficiency [8, 9]. Pumpkin seeds can be used as whole or in the form of flour to supplement the food products. Considering, the nutritional deficiencies and health problems among people in developing countries, the current study is designed to develop widely consumed food product i.e. cookies with incorporation of pumpkin seeds for nutritional enhancement and to evaluate the chemical composition and sensory parameters of supplemented cookies.

Material and Methods

Procurement of pumpkin seeds and preparation of flour

Pumpkin seeds (Punjab Samrat) were procured from the Department of Vegetable Science, Punjab Agricultural University, Ludhiana. Wheat flour and other ingredients were bought from local market of Ludhiana.

Preparation of flour



Formulation and organoleptic evaluation of cookies

Cookies were prepared and standardized in the Food Laboratory of Department of Food and Nutrition, College of Home Science, PAU, Ludhiana. These products were prepared using standardized recipe with the supplementation of raw and roasted pumpkin seed flour at different levels ranging from 15-45% (**Table 1**). One control and six experimental samples of cookies were prepared. The developed cookies were organoleptically evaluated by a semi-trained panel of 10 non-smoker female judges from Department of Food and Nutrition, College of Home Science, Punjab Agricultural University, Ludhiana. The judges were served cookies with one control and six experimental samples in a food laboratory. The samples were coded to avoid any biased judgement. Each sample was tested and mean scores were calculated. Judges were asked to score the samples for appearance, color, texture, flavor, taste and overall acceptability using a score card of 9-point Hedonic Rating Scale by Larmond [10].

Table 1 Ingredients and method used to prepare cookies

Product	**Ingredients used**		**Method**
	Control	**Supplemented samples**	
Cookies	Refined wheat flour (120g) Powdered sugar (60g) Butter (70g) Milk (13ml) Baking powder (1.25g)	Refined wheat flour (102/84/66g) Raw/Roasted pumpkin seed flour (18/36/54g) Powdered sugar (60g) Butter (70g) Milk (13ml) Baking powder (1.25g)	• Fat was rubbed on a clean surface till it becomes light. • Sugar was added to fat and rubbed again. • Flours were sifted and baking powder was added gradually. • Smooth dough was made by using milk. • Dough was rolled to ¼ inch thickness. • Round shapes were cut and baked at 150° C for 20 minutes.

Chemical analysis

After the development and organoleptic evaluation of all samples of cookies, the highest acceptable cookies along with its corresponding control were weighed, homogenized and oven dried at 60° C. Dried samples were stored in air tight plastic bags for further nutritional evaluation. Estimation of proximate composition i.e. moisture, protein, fat, fiber, ash, carbohydrate, energy and estimation of minerals i.e. iron, zinc was done by using standardized methods of AOAC [11]. Estimation of total carotenoid content was done by following the method of Ranganna [12]. Estimation of antioxidant activity was done by using DPPH method given by Liang Yu [13]. Estimation of peroxide value was also carried out by using standard method of AOAC [11].

Statistical Analysis

The data was analyzed with the help of various statistical tools such as mean and standard error. To test the significant difference between the control and experimental samples, Analysis of variance (ANOVA) was applied using SPSS 16 software.

Result and Discussion

Organoleptic evaluation of the cookies

Bakery product i.e. cookies with the supplementation of pumpkin seed flour (raw and roasted) were liked very much by the judges. Cookies supplemented with pumpkin seed flour were found to be highly acceptable at 30% level. Overall acceptability mean scores for acceptable cookies were 7.66 (raw pumpkin seed flour) and 7.62 (roasted pumpkin seed flour). Non-significant differences were found in all the attributes. Organoleptic score of cookies is presented in **Table 2**. Cookies supplemented with raw pumpkin seed flour gained maximum acceptability scores as compared to the cookies supplemented with roasted pumpkin seed flour. Control sample obtained lower acceptability scores than the test samples due to the improved appearance, colour, nutty flavour and taste.

Table 2 Organoleptic scores for *Cookies* supplemented with raw and roasted pumpkin seed flour

Levels	Appearance	Colour	Texture	Flavour	Taste	Overall Acceptability
C	7.6^{a}±0.16	7.5^{a}±0.17	7.3^{a}±0.15	7.6^{a}±0.16	7.5^{a}±0.17	7.50^{a}±0.07
T1	7.5^{a}±0.17	7.3^{a}±0.15	7.5^{a}±0.17	7.6^{a}±0.16	7.7^{a}±0.15	7.52^{a}±0.09
T2*	7.6^{a}±0.16	7.6^{a}±0.16	7.5^{a}±0.17	7.8^{a}±0.13	7.8^{a}±0.13	7.66^{a}±0.11
T3	7.4^{a}±0.16	7.4^{a}±0.16	7.6^{a}±0.16	7.5^{a}±0.17	7.6^{a}±0.16	7.50^{a}±0.09
T4	7.6^{a}±0.16	7.6^{a}±0.16	7.5^{a}±0.17	7.6^{a}±0.16	7.6^{a}±0.16	7.58^{a}±0.15
T5*	7.7^{a}±0.15	7.6^{a}±0.16	7.5^{a}±0.17	7.6^{a}±0.16	7.7^{a}±0.15	7.62^{a}±0.11
T6	7.5^{a}±0.17	7.6^{a}±0.16	7.6^{a}±0.16	7.5^{a}±0.17	7.6^{a}±0.16	7.56^{a}±0.10

Mean±SD with different notation (a, b and c) indicates significant difference at 5% level of significance.
C- Control (0% supplementation),
Raw pumpkin seed flour (T1- 15% T2- 30% and T3- 45%)
Roasted pumpkin seed flour (T4- 15% T5- 30% and T6- 45%)
*most acceptable level of supplementation (30% supplementation) when compared to control sample.

Proximate composition of developed cookies

Data on proximate composition of cookies is given in **Table 3**. It was found that the moisture content of control sample was 8.77% which was higher than the T2 treatment (30% raw pumpkin seed flour) with 6.43% and T5 treatment (30% roasted pumpkin seed flour) had least moisture content i.e.4.96%. Protein content of control sample (6.02%) was significantly lower than the T2 (8.29%) and T5 (8.32%) treatments. Fat content was higher in T5 treatment with 28.97% than the T2 treatment with 28.83% followed by the control sample with 24.55%. Fiber content of T2 (2.50%) and T5 (2.46%) was significantly increased from control sample (0.33%). Ash content was also lower in control sample i.e. 1.06% as compared to T2 and T5 treatments i.e. 2.52 and 2.36%. But carbohydrates were higher in control sample with 59.27 g than T5 treatment with 52.93 g followed by T2 treatment with 51.93 g. Energy content was higher in T5 treatment (505.73 Kcal) than T2 treatment (498.35 Kcal) whereas control sample had least energy content i.e. 482.11 Kcal. From the results, it was concluded that the supplementation of raw or roasted pumpkin seed flour in *cookies* leads to significant increase in nutrient content as compared to the control *cookies*. Kanwal *et al* [14] evaluated the moisture, protein, fat, ash, fiber of control biscuits and biscuits supplemented with 20% pumpkin seed flour as 4.76, 9.20, 20.39, 1.68, 3.40% and 1.55, 12.30, 28.29, 4.13, 1.60%. Seth and Kochhar [15] found that the nutritional value of control and experimental cookies supplemented with 10% level of partially defatted peanut flour per 100 gm as following: energy 530.90 and 534.33 Kcal, moisture 13.09 and 12.47%, protein 4.71 and 6.21%, fat 26.86 and 28.51%, fiber 0.12 and 0.60%, ash 1.34 and 1.48%, carbohydrates 66.25 and 62.87%.

Table 3 Proximate composition of pumpkin seed supplemented cookies

Treatment	Moisture (%)	Protein (%)	Fat (%)	Fiber (%)	Ash (%)	CHO (g)	Energy (Kcal)
Control	8.77^{a}±0.006	6.02^{c}±0.006	24.55^{c}±0.006	0.33^{c}±0.006	1.06^{c}±0.006	59.27	482.11
Accepted (Raw) T2-30% supplementation	6.43^{b}±0.006	8.29^{b}±0.006	28.83^{b}±0.006	2.50^{a}±0.006	2.52^{a}±0.006	51.43	498.35
Accepted (Roasted) T5-30% supplementation	4.96^{c}±0.006	8.32^{a}±0.006	28.97^{a}±0.006	2.46^{b}±0.006	2.36^{b}±0.006	52.93	505.73

Values are expressed as Mean±SE
Means with different notation (a, b and c) indicates significant difference at 5% level of significance

Mineral content of pumpkin seed flour supplemented cookies

Mineral i.e. iron and zinc content of cookies is presented in Table 4.

Iron

Results revealed that the iron content of supplemented cookies was higher than their control samples. In cookies, T2 contained higher iron content with 2.36 mg followed by T5 with 2.18 mg and further followed by control sample (refined wheat flour) with 1.31 mg. Abd El-Ghany *et al* [16] analyzed the mineral content of pumpkin seeds and reported that the iron content of seeds as 9.76 mg/100gm. Kanwal *et al* [13] studied the iron content of biscuits supplemented with 33% pumpkin seed flour and found that biscuits contained 2.28 mg/100gm. Whereas control biscuits contained 0.364 mg/100gm which was lesser as compared to the supplemented biscuits. Thus iron content of all the cookies significantly increased with the supplementation of raw and roasted pumpkin seed flour.

Zinc

From the results, it was found that the zinc content of the cookies supplemented with raw and roasted pumpkin seed flour was as 1.28 and 1.22 mg/100gm. Control sample had lower zinc content than the treatments. Kanwal *et al* [13] studied the iron content of biscuits supplemented with 33% pumpkin seed flour and found that biscuits contained 3.11 mg/100gm which was higher than the control biscuits made from refined flour i.e. 0.96 mg/100gm. Thus zinc content of *cake* and *cookies* significantly increased with the supplementation of raw and roasted pumpkin seed flour.

Table 4 Mineral content of pumpkin seed supplemented cookies

Treatment	Iron (mg/100g)	Zinc (mg/100g)
Control	1.31^{c}±0.006	0.23^{c}±0.006
Accepted (Raw) T2-30% supplementation	2.36^{a}±0.006	1.28^{a}±0.006
Accepted (Roasted) T5-30% supplementation	2.18^{b}±0.006	1.22^{b}±0.006

Values are expressed as Mean±SE
Means with different notation (a, b and c) indicates significant difference at 5% level of significance.

Antioxidant compounds and peroxide value of pumpkin seed supplemented cookies

Antioxidant compounds and peroxide value of cookies is presented in Table 5.

Total Carotenoid Content

From the results, it is observed that carotenoid content of all samples of cookies was significantly different. TCC of accepted cookies supplemented with raw and roasted flour was 0.231 and 0.208 mg/100gm. TCC content of control sample was lower than the supplemented. Thus the total carotenoid content of cookies supplemented with pumpkin seed flour whether in raw or roasted form showed an increase as compared to the control sample. Kim *et al* [17] found that the pumpkin seeds of *Cucurbita moschata* variety contained 7.15 mg/kg β-carotene. Siano *et al* [18] studied the TCC of pumpkin seed oil which was 107.5µg β-carotene per kg oil.

Total Antioxidant Activity

It was found that there was more TAA in T2 treatment cookies (30% raw pumpkin seed flour) with 58.10% than the T5 treatment cookies (30% roasted pumpkin seed flour) with 54.80% whereas the control sample (refined wheat flour) had 49.50%. Thus total antioxidant activity was found higher in the cookies supplemented with raw pumpkin seed flour followed by the cookies supplemented with roasted pumpkin seed flour whereas control sample had comparatively less TAA. Nyam *et al* [7] found that DPPH radical scavenging activity of pumpkin seeds is 36.97%. He also prepared bread supplemented with 5% pumpkin seeds. Results showed a 37.99% increase in DPPH radical scavenging activity in pumpkin seed bread as compared to control bread.

Peroxide Value

Peroxide value of raw and roasted pumpkin seed flour supplemented cookies was 2.8 and 2.2 meq/kg respectively.

Control samples of cookies had significantly higher peroxide value than the treatment samples i.e. cookies supplemented with raw and roasted pumpkin seed flour at different levels of incorporation which implies that the supplementation of pumpkin seed flour whether in raw or roasted form reduces the chances of rancidity and increase the shelf life of products. Srbinoska *et al* [19] studied the peroxide value of pumpkin seed whole and pumpkin seed kernel of two different varieties. Results showed that the peroxide value of whole seed of *Cucurbita maxima* was 4.93 meq/kg extract whereas in *Cucurbita pepo*, it was 6.06 meq/kg extract for whole seed.

Table 5 Antioxidant compounds and peroxide value in pumpkin seed supplemented cookies

Treatment	Total Carotenoid Content (mg/100g)	Total Antioxidant Activity (%)	Peroxide Value (meq/kg)
Control	0.019^{c}±0.0006	49.50^{c}±0.006	3.7^{a}±0.06
Accepted (Raw) T2-30% supplementation	0.231^{a}±0.0006	58.10^{a}±0.006	2.8^{b}±0.06
Accepted (Roasted) T5-30% supplementation	0.208^{b}±0.0006	54.80^{b}±0.006	2.2^{c}±0.06

Values are expressed as Mean±SE
Means with different notation (a, b and c) indicates significant difference at 5% level of significance.

Conclusion

From the above results, it was observed that pumpkin seed flour supplementation whether in raw or roasted form in worldwide favourite bakery product i.e. cookies is highly acceptable than the control samples. Supplementation of pumpkin seed flour upto 30% level is maximum acceptable. Protein, fat, ash, iron, zinc, total carotenoid content, antioxidant activity was increased in the cookies supplemented with raw or roasted pumpkin seed flour than the control samples. Peroxide value was lower in supplemented cookies. Thus, it can be concluded that the consumption of pumpkin seed flour supplemented products should be encouraged in routine diet so as to improve the nutritional status of the individuals. Value added products using raw or roasted pumpkin seed flour can be supplemented to children and women to eradicate malnutrition. Cookies can also become a part of the supplementary feeding programmes.

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