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Development and nutritional evaluation of cake supplemented with pumpkin seed flour

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ABSTRACT

A healthy and well-nourished person depends on healthy food system. Today, malnutrition imposes high cost on society. In recent times, more attention has been given to the appropriate use of agricultural waste to overcome malnutrition. Pumpkin seeds are nutritionally dense by-product of pumpkin but commonly discarded as waste. The purpose of the study was proper utilization of pumpkin seeds to supplement bakery product i.e. cake to enhance nutritional content. Pumpkin seeds were processed into raw and roasted flour. Cake was prepared by supplementing both raw and roasted pumpkin seed flour. Organoleptic evaluation was done. Cake was highly accepted at 20% level. Moisture content was higher in control cake i.e. 20.26%, protein content was maximum in cake supplemented with roasted pumpkin seed flour (8.45%), fat content was higher in cake supplemented with roasted pumpkin seed flour (21.08%), fiber and ash content of cake supplemented with raw pumpkin seed flour was higher i.e. 1.80 and 1.59%. Iron and zinc content was higher in cake supplemented with raw pumpkin seed flour i.e. 2.04 and 0.64mg/100g. Total carotenoid content was maximum in cake supplemented with raw pumpkin seed flour (0.190mg/100g). Maximum antioxidant activity was observed in cake supplemented with raw pumpkin seed flour (60.30%). Peroxide value was higher in control cake (5.0 meq/kg).

Key words: Bakery product, Cake, Malnutrition, Nutritional content, Organoleptic evaluation, Pumpkin seeds.

INTRODUCTION

Numeral ways or ideas of intensifying the use of available local food are increasingly pursued but information of the nutritive value of such local foodstuffs and ingredients is also crucial in order to encourage the consumption. Knowledge of the nutritive value is essential for supple menting staple foods to increase the nutritional status of people. Worldwide, a lot research has focused on increasing the nutritional value of food products at economical level. But this type of effort could be done economically only in the locations where the availability of valuable resources is in huge quantities.

Pumpkin belongs to the family *Cucurbitaceae*. Pumpkin has gained extensive attention in current times due to the good nutritional composition and health shielding values of its seeds. Pumpkin seeds, also known as pepitas which are small, flat, green, edible seeds. These seeds are the most important part of pumpkin but are mostly discarded as waste. But now days, pumpkin seeds are subjected to industrial processing and have been commonly commercialized as a salty snack.

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 (Milovanoic and Vucelic-Radovic, 2008). These seeds are also rich in phytosterols (Phillips *et al.,* 2005; Ryan *et al.,* 2007), polyunsaturated fatty acids (Applequist *et al.,* 2006; Sabudak, 2007), antioxidant vitamins such as carotenoids and tocopherol (Stevenson *et al.,* 2007), trace elements such as zinc (Glew *et al.,* 2006), iron and magnesium (Lim, 2012). Pumpkin seeds are also known for pharmacological activities like anti-fungal (Wang and Ng, 2003), anti-diabetic (Quanhong *et al.,* 2003), anti-bacterial and anti-inflammation activities (Caili *et al.,* 2006) and anti-oxidant effects (Nkosi *et al.,* 2006). Pumpkin seeds (*Cucurbita maxima*) can reverse the depletion of cell mediated immune response in rabbits due to the presence of phytochemicals in seeds (Ranganathan and Selvasubramanian, 2015).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 (El Adawy and Taha, 2001; Patel, 2013).

A pleasing green color and nutty taste of pumpkin seed flour makes it feasible to use them to develop new food products with nutrient adequacy. It is used to fortify wheat flour to produce bakery products like pastries with unique and nutty taste (Patel, 2013). Above mentioned all properties of pumpkin seed flour makes it potentially valuable supplement to food products to overcome the malnutrition among children in India.

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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 India, the current study is designed to develop food product with incorporation of pumpkin seeds for nutritional enhancement and to evaluate the chemical composition and sensory parameters of supplemented product.

Objectives

- To develop and organoleptically evaluate pumpkin seed flour supplemented cake.
- To study the nutritional composition of pumpkin seed flour supplemented cake.

MATERIALS 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.

Preparation of flour:

-Raw flour:	-Roasted flour:
↓	↓
Selection of pumpkin seeds	Selection of pumpkin seeds
↓	↓
Cleaning of pumpkin seeds	Cleaning of pumpkin seeds
↓	↓
Sun drying	Sun drying
↓	↓
Powdered	Roasting for 15-20 mins at 75°C
↓	↓
Flour	Powdere
	↓
	Flour

Development and organoleptic evaluation of cake: The bakery product i.e. *cake* was prepared in the Food Laboratory of Department of Food and Nutrition, College of Home Science, PAU. Cake was prepared using standardized recipe with the supplementation of raw and roasted pumpkin seed flour at different levels ranging from 10-30% (Table 1). For the study, one control and six experimental samples were prepared. The developed product was 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 each preparation 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 (Larmond, 1970).

Chemical analysis: After the development and organoleptic evaluation of products, the highest acceptable product samples 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 AOAC (2000) standardized methods. Estimation of total carotenoid content was done by following the method of Ranganna (2002). Estimation of antioxidant activity was done by using DPPH method given by Liang Yu (2008). Estimation of peroxide value was also carried out by using standard method of AOAC (2000).

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.

RESULTS AND DISCUSSION

Organoleptic evaluation of the developed cake: Bakery products i.e. *cake* with the supplementation of pumpkin seed flour (raw and roasted) was found to be highly acceptable at 20% level. Organoleptic score of cake is presented in Table 2. Cake supplemented with raw pumpkin seed flour gained maximum overall acceptability score (7.66) as compared to the cake supplemented roasted pumpkin seed flour (7.64).

Table 1: Ingredients used in the cake.

Product	Ingredients used		Method
	Control	Supplemented products	
Cake	Refined wheat flour (120g) Powdered sugar (120g) Butter (60g) Eggs (2) Baking powder (2.5g) Vanilla essence (5ml)	Refined wheat flour (108/96/84g) Raw/Roasted pumpkin seed flour (12/24/36g) Powdered sugar (120g) Butter (60g) Eggs (2) Baking powder (2.5g) Vanilla essence (5ml)	1.Flours and baking powder were sifted twice. 2.Fat and sugar were creamed together till light and fluffy. 3.Eggs were beaten along with vanilla essence. 4.Beaten eggs were added to the creamy mixture little by little mixing continuously. 5.Flour was folded gently using cut-and-fold method. 6.Milk was added to bring the mixture to dropping consistency. 7.Mixture was poured in a greased and dusted cake tin and levelled it properly. 8.Cake was baked at 180°C for 20 minutes. 9.Cooled on a cooling-rack.

Table 2: Organoleptic scores for cake supplemented with raw and roasted pumpkin seed flour.

Levels	Appearance	Colour	Texture	Flavour	Taste	Overall Acceptability
C	7.7^{a}±0.15	7.6^{a}±0.16	7.6^{a}±0.16	7.3^{a}±0.15	7.7^{a}±0.15	7.58^{a}±0.12
T1	7.4^{a}±0.16	7.5^{a}±0.17	7.3^{a}±0.15	7.2^{a}±0.13	7.6^{a}±0.16	7.40^{a}±0.11
T2*	7.8^{a}±0.13	7.6^{a}±0.16	7.5^{a}±0.17	7.7^{a}±0.15	7.7^{a}±0.15	7.66^{a}±0.09
T3	7.5^{a}±0.17	7.5^{a}±0.17	7.5^{a}±0.17	7.3^{a}±0.15	7.5^{a}±0.17	7.46^{a}±0.09
T4	7.2^{ab}±0.13	7.5^{a}±0.17	7.1^{a}±0.10	7.1^{a}±0.10	7.7^{a}±0.15	7.32^{a}±0.04
T5*	7.7^{a}±0.15	7.5^{a}±0.17	7.6^{a}±0.16	7.6^{a}±0.16	7.8^{a}±0.13	7.64^{a}±0.10
T6	7.1^{b}±0.10	7.3^{a}±0.15	7.4^{a}±0.16	7.4^{a}±0.16	7.6^{a}±0.16	7.36^{a}±0.09

Means±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- 10% T2- 20% and T3- 30%)
Roasted pumpkin seed flour(T4- 10% T5- 20% and T6- 30%)
*most acceptable level of supplementation (20% supplementation) when compared to control sample.

Table 3: Proximate composition of pumpkin seed supplemented cake.

Treatment	Control	Accepted(Raw) T2-20% supplementation	Accepted (Roasted) T5-20% supplementation
Moisture(%)	20.26^{a}±0.006	18.34^{b}±0.006	$17.97\pm^{c}0.006$
Protein(%)	7.17^{c}±0.006	8.10^{b}±0.006	8.45^{a}±0.006
Fat(%)	17.40^{c}±0.006	20.94^{b}±0.006	21.08^{a}±0.006
Fiber(%)	0.31^{c}±0.006	1.80^{a}±0.006	1.71^{b}±0.006
Ash(%)	0.94^{c}±0.006	1.59^{a}±0.006	1.52^{b}±0.006
CHO(g)	53.92	49.23	49.27
Energy(Kcal)	401.26	417.78	420.60

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

Control sample obtained lower acceptability score than the test samples due to the improved appearance, colour, nutty flavour and taste.

Proximate composition of developed cake

Data on proximate composition of cake is given in Table 3.

Cake: The moisture content of control sample (20.26%) was significantly higher than the T2 treatment (20% raw pumpkin seed flour) i.e. 18.34% followed by T5 treatment (20% roasted pumpkin seed flour) with 17.97%. There was a significant increase in protein content of T5 and T2 treatment i.e. 8.45 and 8.10% from the control sample with 7.17%. Fat content was also maximum in T5 treatment with 21.08% followed by T2 treatment with 20.94% and further followed by control sample with 17.40%. Fiber content of control sample (0.31%) was quite lower as compared to T2 and T5 treatment i.e. 1.80 and 1.71%. Ash content of control sample was also significantly lower with 0.94% than the T2 and T5 treatment which had 1.59 and 1.52%. Both the T2 and T5 treatments contained low carbohydrate content i.e. 49.23 and 49.27 g than the control sample (53.92 g). Energy content of T5 treatment was found to be higher with 420.60 kcal followed by T2 treatment with 417.78 Kcal whereas control sample had less energy content i.e. 401.26 Kcal. Thus with the supplementation of pumpkin seed flour (raw or roasted) significantly affects the nutritional composition of *cake* as compared to the control *cake* made of refined flour. Bialek *et al* (2016) found the nutritional value of control and experimental muffins supplemented with 33% pumpkin seed flour per 100 gm as following: energy 341 and 388 Kcal, protein 6.50 and 14.10 gm, fat 13.40 and 14.30 gm, monosaccharides 46.10 and 44.30 gm and fiber 1.20 and 1.90 gm.

Mineral content of pumpkin seed flour supplemented cake

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

Iron: Results revealed that the iron content of supplemented cake was higher than the control sample. It was observed that T2 treatment (20% raw pumpkin seed flour) contained more iron i.e. 2.04 mg as compared to T5 (20% roasted pumpkin seed flour) and control sample (refined wheat flour) which was 1.96 and 1.24 mg. Abd El-Ghany *et al* (2010) analyzed the mineral content of pumpkin seeds and reported that the iron content of seeds as 9.76 mg/100gm. Kanwal *et al* (2015) 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 cake 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 cake supplemented with raw and roasted pumpkin seed

Table 4: Mineral content of pumpkin seed supplemented cake.

Treatment	Iron (mg/100g)	Zinc (mg/100g)
Cake		
Control	1.24^{c}±0.006	0.20^{b}±0.006
Accepted (Raw) T2-20% supplementation	2.04^{a}±0.006	0.64^{a}±0.006
Accepted (Roasted) T5-20% supplementation	1.96^{b}±0.006	0.63^{a}±0.006

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

Table 5: Antioxidant compounds and peroxide value in pumpkin seed supplemented cake.

Treatment	Total Carotenoid Content (mg/100g)	Total Antioxidant Activity (%)	Peroxide Value (meq/kg)
Cake			
Control	0.022^{c}±0.0006	52.70^{c}±0.006	5.0^{a}±0.58
Accepted (Raw) T2-20% supplementation	0.190^{a}±0.0006	60.30^{a}±0.006	3.6^{b}±0.06
Accepted (Roasted) T5-20% supplementation	0.184^{b}±0.0006	57.00^{b}±0.578	3.5^{b}±0.06

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

flour was as 0.64 and 0.63 mg/100gm. Control sample of cake had lower zinc content than the treatments. Kanwal *et al* (2015) 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 significantly increased with the supplementation of raw and roasted pumpkin seed flour.

Antioxidant compounds and peroxide value of pumpkin seed supplemented product

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

Total carotenoid content: From the results, it is observed that carotenoid content of cake supplemented raw pumpkin seed flour was 0.190mg/100gm which was higher than the cake supplemented with roasted pumpkin seed flour i.e. 0.184mg/100gm. Control sample was found to have lower TCC content than the supplemented. Thus the total carotenoid content of cake supplemented with pumpkin seed flour whether in raw or roasted form showed an increase as compared to the control sample. Kim *et al* (2012) found that the pumpkin seeds of *Cucurbita moschata* variety contained 7.15 mg/kg β-carotene. Siano *et al* (2016) studied the TCC of pumpkin seed oil which was 107.5 µg β-carotene per kg oil.

Total antioxidant activity: It was found that the T2 (20% raw pumpkin seed flour) cake had higher TAA (60.30%) followed by T5 (20% roasted pumpkin seed flour) *cake* i.e. 57.00%. whereas the control sample (refined wheat flour) had 52.70%. Thus total antioxidant activity was found higher in the product supplemented with raw pumpkin seed flour followed by the product supplemented with roasted pumpkin seed flour whereas control sample had comparatively less TAA. Nyam *et al.* (2013) 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 raw and roasted pumpkin seed flour supplemented product i.e. cake, cookies was 3.6 and 3.5 meq/kg respectively. Control sample of cake had significantly higher peroxide value than the treatment samples i.e. product 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* (2012) 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.

CONCLUSION

From the above results, it was observed that pumpkin seed flour supplementation whether in raw or roasted form in bakery product like cake is highly acceptable than the control samples. Protein, fat, ash, iron, zinc, total carotenoid content, antioxidant activity was increased in the cake supplemented with raw or roasted pumpkin seed flour than the control samples. Peroxide value was found lower in supplemented cake. 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. These products can also become a part of the supplementary feeding programmes.

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