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Development and nutritional evaluation of pumpkin seed (*Cucurbita moschata*) supplemented products

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Pumpkin seeds are nutritionally dense food but commonly discarded as waste. Keeping in view the economic and nutritional benefits of pumpkin seeds, the products supplemented with them can be incorporated in daily diet to enhance the nutritional status of people. Due to the high prevalence of malnutrition and iron deficiency anaemia in children and women, the present study was aimed at the development and nutritional evaluation of food products supplemented with pumpkin seeds. Food products namely *Laddoo, Panjeeri* and *Mathi* were developed using standardized recipes with different levels of pumpkin seed flour in raw and roasted form. These products were organoleptically evaluated by a trained panel of 12 judges using nine point hedonic rating scale. Nutritional evaluation was also carried out to draw comparison between the developed products and its control (0% supplementation) counterpart. Results revealed that 30% supplementation of pumpkin seed flour (raw and roasted) in all the products is most acceptable. The supplemented products were found to have higher protein (8.97 to 12.07%), fat (31.55 to 45.56%), fibre (2.04 to 3.21%), ash (1.69 to 2.55%), iron (2.50 to 3.29mg/100g) and zinc (1.45 to 2.08mg/100g) content as compared to the control (0% supplementation). Moreover addition of pumpkin seed flour resulted in significant increase in the total carotenoid content (0.090 to 0.370meq/kg) and antioxidant activity (59.10 to 74.20%) of the supplemented products.

Key Words : Malnutrition, Pumpkin seed, Supplemented products, Organoleptic evaluation, Nutritional analysis.

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INTRODUCTION

A healthy and well-nourished person depends on healthy food system. Today, malnutrition imposes high cost on the society. Malnutrition comes in many forms and under- nutrition is most prevalent form of malnutrition in developing countries. One out of five children are stunted and around 165 million children in the world are malnourished (FAO, 2013). Moreover, about 2 billion people in the world lack vitamins and minerals which are essential for healthy life (FAO/WHO, 2004). Half of the humankind is affected by the deficiency of trace elements (WHO/EMRO, 2009).

In developing countries, availability of animal origin protein is inadequate to meet the daily requirements of protein of the rapidly rising population. Therefore, it is necessary to gear up the present-day research efforts to study the properties of food and potential of utilization of protein and other required nutrients from the local food crops which are not utilized efficiently (Enujiugha and Ayodele-Oni, 2003). Besides cereals and pulses, which form important sources of protein in the diets of majority of population in the developing countries, oilseeds and oilseed meals represent as the most important source of

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proteins which have not been fully exploited so far for supplementing human diet. The problem of providing low cost balanced protein supplements utilizing oilseeds and oilseed meals for combating malnutrition in under-developed countries has been engaging the attention of scientists in several countries. Oilseeds add a significant nutritional value to the diet due to their high quality protein (Sarwar, 2013).Significant consideration has been given to enrich wheat flour products with high protein oilseed flour (Hoover, 1979).

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. Pumpkin seeds are loaded with nutrients and medicinal properties. Pumpkin seeds are rich natural source of protein (25 to 37%) and oil (37 to 45%) and are renowned as valuable oil seeds loaded with protein for human consumption (Milovanoic and Vucelic-Radovic, 2008). Edible oil extracted from pumpkin seeds has been highly acceptable and considered very healthy (Bastic *et al*., 1977). Pumpkin seeds and pumpkin seed oil is loaded with unsaturated fatty acids especially omega 3 fatty acids (Murkovic *et al*., 1996). These seeds are also rich in phytosterols (Phillips *et al.*, 2005 and Ryan *et al*., 2007), polyunsaturated fatty acids (Applequist *et al*., 2006 and 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). 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 and Patel, 2013). A pleasing green colour and nutty taste of pumpkin seed flour makes it feasible to use them to develop new food products with nutrient adequacy and thus a valuable supplement to food products to overcome malnutrition among children in India.

Considering, the nutritional deficiencies and health problems among people in India, the current study is designed to develop food products with incorporation of pumpkin seeds for nutritional enhancement and to evaluate the chemical composition and sensory parameters of supplemented food products.

Objectives :

– To develop and organoleptically evaluate pumpkin seed flour supplemented products.

– To study the nutritional composition of supplemented products.

METHODOLOGY

Procurement of pumpkin seeds and preparation of flour :

Pumpkin seeds (Punjab Samrat) were procured from the Department of Vegetable Science, Punjab Agricultural University, Ludhiana.

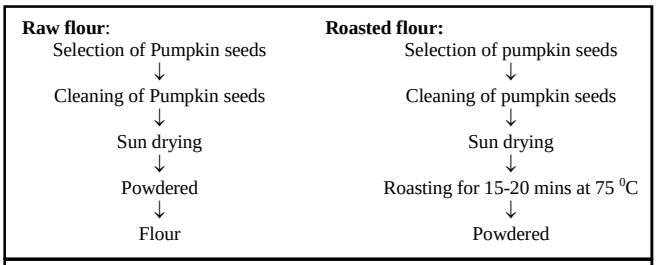

Fig. A : Preparation of flour

Development and organoleptic evaluation of products :

Products namely *Laddoo*, *Panjeeri*, *Mathi* were prepared in the Food Laboratory of Department of Food and Nutrition, College of Home Science, PAU. 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 A). For each recipe, one control and six experimental samples were prepared. The developed products were organoleptically evaluated by a trained panel of 10 judges. 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 product was tested and mean scores were calculated. Judges were asked to score the samples for appearance, colour, texture, flavour, taste and overall acceptability using a score card of 9-point Hedonic Rating Scale (Larmond, 1970).

Chemical analysis :

After the development and organoleptic evaluation

Table A : Ingredients used in the products

Product	Ingredients used		Method
	Control	Supplemented products	
Laddoo	Bengal gram flour (100g) Ghee (50g) Powdered sugar (50g)	Bengal gram flour (85/70/55g) Raw/Roasted pumpkin seed flour (15/30/45g) Ghee (50g) Powdered sugar (50g)	Heat ghee in a kadahi, add bengal gram flour and roast on low heat till light brown color. Allow the mixture to cool slightly, add pumpkin seed flour, sugar and mix well. Roll into even sized *Laddoo* and serve.
Panjeeri	Whole wheat flour (100g) Ghee (50g) Powdered sugar (35g)	Whole wheat flour (85/70/55g) Raw/Roasted pumpkin seed flour (15/30/45g) Ghee (50g) Powdered sugar (50g)	Take kadahi and heat ghee in it. Put wheat flour in it and roast it. Remove flour from flame and add pumpkin seed flour and sugar. Mix it well and serve.
Mathi	Refined wheat flour (100g) Ghee (20g) Carom seeds (1g) Salt (1g) Refined oil (50g)	Refined wheat flour (85/70/55g) Raw/Roasted pumpkin seed flour (15/30/45g) Ghee (20g) Carom seeds (1g) Salt (1g) Refined oil (50g)	Add pumpkin seed flour, salt and carom seeds to the refined wheat flour. Add fat to the flour as shortening and mix thoroughly. Knead it into a stiff dough. Divide the dough into small balls and roll the balls into shape of *Mathi*. Prick the rolled *Mathi* with knife so that it remains flat even after frying. Deep fry the *Mathi* till golden brown colour.

of products, the highest acceptable products along with its corresponding control (0% supplementation)were weighed, homogenized and oven dried at 60° C. Estimation of proximate composition *i.e.* moisture, protein, fat, fibre, 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),antioxidant activity was done by using DPPH method given by Liang (2008) and peroxide value 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.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Organoleptic evaluation of the developed products:

All the developed products *i.e. Laddoo, Panjeeri* and *Mathi* with the supplementation of pumpkin seed flour (raw and roasted) were found to be highly acceptable at 30% level. All the products were liked very much with an overall acceptability mean scores for *Laddoo* (raw- 7.68 and roasted- 7.62), *Panjeeri* (raw- 7.82 and roasted- 7.66) and *Mathi* (raw- 7.50 and roasted- 7.62). Organoleptic scores of *Laddoo, Panjeeri* and *Mathi* a represented in Table 1 to 3. The products supplemented with raw pumpkin seed flour gained maximum acceptability scores as compared to the products supplemented with roasted pumpkin seed flour except *Mathi*. Control sample of all products obtained lower acceptability scores than the test samples due to the improved appearance, colour, nutty flavour and taste of the supplemented products.

Proximate composition of developed products :

Proximate composition of all three products is presented in Table 4.

***Laddoo*:**

The moisture content of *Laddoo* was 2.82 per cent for control whereas 2.28 and 1.96 per cent for T_2 treatment (30% raw pumpkin seed flour) and T_5 treatment (30% roasted pumpkin seed flour) which were significantly different. The protein content of both acceptable sample T_2 and T_5 *i.e.* 11.72 and 12.07% was significantly higher than the control sample *i.e.* 9.97%. The fat content of control sample was 27.45% which was significantly lower than the both test samples. There was a significant increase in the fibre content of T_2 (3.21%) and T_5 (3.18%) treatments than the control

(1.69%). The ash content of both the treatments, T_2 (2.46%) and T_5 (2.33%) was higher than the control sample (1.41%). The carbohydrate content of control was significantly higher *i.e.* 56.46 g than T_5 treatment (51.94 g) followed by T_2 treatment (51.22 g). Energy content was found to be highest in T_5 treatment *i.e.* 547.64 Kcal followed by T_2 treatment (535.71 Kcal) and control sample (514.57 Kcal). Thus with the supplementation of pumpkin seed flour (raw and roasted), there was a significant increase in the nutritional composition of *Laddoo* as compared to the *Laddoo* made from bengal gram flour. There was a significant increase in protein, fat, fibre, ash and energy content.Srivastava and Verma (2014) analyzed the proximate composition of *Laddoo* supplemented with 35% sunflower seeds flour and they found the energy 683.35 Kcal, protein 14.79 g, fat 40 gm and carbohydrate

Table 1 : Organoleptic scores for *Laddoo* supplemented with raw and roasted pumpkin seed flour

Levels	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	$7.5^{a}\pm0.17$	$7.4^{a}\pm0.16$	$7.5^{a}\pm0.17$	$7.3^{b}\pm0.15$	$7.5^{a}\pm0.17$	$7.44^{a}\pm0.12$
T_1	$7.5^{a}\pm0.17$	$7.5^{a}\pm0.17$	$7.5^{a}\pm0.17$	$7.6^{ab}\pm0.16$	$7.6^{a}\pm0.16$	$7.54^{a}\pm0.10$
T_2^{*}	$7.6^{a}\pm0.16$	$7.7^{a}\pm0.15$	$7.4^{a}\pm0.16$	$7.9^{a}\pm0.10$	$7.8^{a}\pm0.13$	$7.68^{a}\pm0.03$
T_3	$7.5^{a}\pm0.17$	$7.6^{a}\pm0.16$	$7.3^{a}\pm0.15$	$7.7^{ab}\pm0.15$	$7.5^{a}\pm0.17$	$7.52^{a}\pm0.07$
T_4	$7.4^{a}\pm0.16$	$7.4^{a}\pm0.16$	$7.5^{ab}\pm0.17$	$7.5^{a}\pm0.17$	$7.5^{a}\pm0.17$	$7.46^{ab}\pm0.06$
T_5^{*}	$7.8^{a}\pm0.13$	$7.6^{a}\pm0.16$	$7.8^{a}\pm0.13$	$7.4^{a}\pm0.16$	$7.5^{a}\pm0.17$	$7.62^{a}\pm0.09$
T_6	$7.5^{a}\pm0.17$	$7.2^{a}\pm0.13$	$7.1^{b}\pm0.10$	$7.2^{a}\pm0.13$	$7.3^{a}\pm0.15$	$7.26^{b}\pm0.06$

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 (T_1- 15%, T_2- 30% and T_3- 45%)
Roasted pumpkin seed flour (T_4- 15%, T_5- 30% and T_6- 45%)
*most acceptable level of supplementation (30% supplementation) when compared to control sample.

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

Levels	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	$7.6^{a}\pm0.16$	$7.4^{a}\pm0.16$	$7.6^{ab}\pm0.16$	$7.7^{a}\pm0.15$	$7.6^{a}\pm0.16$	$7.58^{ab}\pm0.07$
T_1	$7.4^{a}\pm0.16$	$7.4^{a}\pm0.16$	$7.6^{ab}\pm0.16$	$7.6^{a}\pm0.16$	$7.7^{a}\pm0.15$	$7.54^{ab}\pm0.07$
T_2^{*}	$7.7^{a}\pm0.15$	$7.8^{a}\pm0.13$	$7.9^{a}\pm0.10$	$7.8^{a}\pm0.13$	$7.9^{a}\pm0.10$	$7.82^{a}\pm0.07$
T_3	$7.6^{a}\pm0.16$	$7.4^{a}\pm0.16$	$7.3^{b}\pm0.15$	$7.0^{b}\pm0.15$	$7.5^{a}\pm0.17$	$7.36^{b}\pm0.09$
T_4	$7.2^{a}\pm0.13$	$6.9^{b}\pm0.18$	$7.2^{b}\pm0.13$	$7.5^{ab}\pm0.17$	$7.7^{a}\pm0.15$	$7.30^{b}\pm0.09$
T_5^{*}	$7.3^{a}\pm0.15$	$7.5^{a}\pm0.17$	$7.9^{a}\pm0.10$	$7.8^{a}\pm0.13$	$7.8^{a}\pm0.13$	$7.66^{a}\pm0.09$
T_6	$7.3^{a}\pm0.15$	$7.1^{ab}\pm0.10$	$7.4^{ab}\pm0.16$	$7.2^{b}\pm0.13$	$7.6^{a}\pm0.16$	$7.32^{b}\pm0.06$

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(T_1- 15%, T_2- 30% and T_3- 45%)
Roasted pumpkin seed flour (T_4- 15%, T_5- 30% and T_6- 45%)
*most acceptable level of supplementation (30% supplementation) when compared to control sample

Table 3 : Organoleptic scores for *Mathi* supplemented with raw and roasted pumpkin seed flour

Levels	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	$7.1^{ab}\pm0.18$	$7.3^{a}\pm0.15$	$7.2^{a}\pm0.20$	$7.2^{a}\pm0.20$	$7.5^{ab}\pm0.17$	$7.26^{a}\pm0.15$
T_1	$6.9^{ab}\pm0.18$	$6.9^{a}\pm0.18$	$7.5^{a}\pm0.17$	$7.6^{a}\pm0.16$	$7.8^{a}\pm0.13$	$7.34^{a}\pm0.14$
T_2	$7.5^{a}\pm0.17$	$7.4^{a}\pm0.16$	$7.6^{a}\pm0.16$	$7.5^{a}\pm0.17$	$7.5^{ab}\pm0.17$	$7.50^{a}\pm0.11$
T_3	$6.8^{b}\pm0.13$	$7.4^{a}\pm0.16$	$7.3^{a}\pm0.15$	$7.5^{a}\pm0.17$	$7.2^{b}\pm0.13$	$7.24^{a}\pm0.10$
T_4	$7.2^{a}\pm0.13$	$7.2^{a}\pm0.13$	$7.5^{a}\pm0.17$	$7.6^{a}\pm0.16$	$7.7^{a}\pm0.15$	$7.44^{a}\pm0.10$
T_5	$7.5^{a}\pm0.17$	$7.5^{a}\pm0.17$	$7.6^{a}\pm0.16$	$7.6^{a}\pm0.16$	$7.9^{a}\pm0.10$	$7.62^{a}\pm0.11$
T_6	$7.3^{a}\pm0.15$	$7.6^{a}\pm0.16$	$7.2^{a}\pm0.13$	$7.5^{a}\pm0.17$	$7.9^{a}\pm0.10$	$7.46^{a}\pm0.10$

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 (T_1- 15%, T_2- 30% and T_3- 45%)
Roasted pumpkin seed flour(T_4- 15% T_5- 30% and T_6- 45%)
*most acceptable level of supplementation (30% supplementation) when compared to control sample

91.13 g which were higher than the control *Laddoo* with energy 680.20 Kcal, protein 12.10 g, fat 21.70 except carbohydrate 109.16 g.

***Panjeeri*:**

It was observed that the moisture content of control *Panjeeri* (whole wheat flour) was 2.76% which was higher than the T_2 treatment (30% raw pumpkin seed flour) *i.e.* 2.62% followed by T_5 treatment (30% roasted pumpkin seed flour) with 2.12% moisture. With the supplementation of pumpkin seed flour, there was a significant increase in protein content as the protein content was found to be significantly higher in T_5 treatment with 9.11% than T_2 treatment and control *i.e.* 8.97% and 6.05%. Fat content of both the treatments T_2 and T_5 (31.57 and 31.88%) was significantly higher than the control sample (26.82%). Fibre content of T_2 (3.16%) and T_5 (3.15%) treatments was almost same but significantly higher than the control sample (1.55%). There was a significant difference between the ash content of control, T_2 treatment and T_5 treatment *i.e.* 1.46, 2.55 and 2.41%. Carbohydrate content of control sample was 61.36 g which was significantly higher than the T_5 treatment *i.e.* 51.33 g followed by T_2 treatment with 51.13 g. Energy content was found to be maximum in T_5 treatment *i.e.* 528.68 Kcal than the T_2 treatment and control sample *i.e.* 524.53 and 511.02 Kcal. Thus it was concluded that with the supplementation of pumpkin seed flour whether in raw or roasted form, there was a significant increase in the nutritional composition of *Panjeeri* as compared to the control *Panjeeri* made from whole wheat flour only. Bansal (2013) evaluated the panjeeri supplemented with 50% partially defatted peanut flour and found the moisture, protein, fat, fibre and ash as 1.45%, 31.00%, 25.50%, 6.00% and 3.80% which were almost higher as compared to the control panjeeri except fat *i.e.* 0.37% moisture, 9.27% protein, 37.45% fat, 1.50% fibre and 3.80% ash. Kaur and Kochhar (2014) analyzed nutritional composition of the control *Panjeeri* (wheat flour only) and panjeeri supplemented with 40% potato flour. Results showed the significant differences in the moisture, protein, fat, fibre, ash content of control and supplemented panjeeri *i.e.* 0.65, 6.60, 25.70, 1.30, 0.67% and 1.35, 7.40, 23.42, 2.40, 0.95%, respectively.

***Mathi* :**

The results revealed that the moisture content of control sample (refined wheat flour) was 2.02% which was significantly higher than both T_2 (30% raw pumpkin seed flour) and T_5 (30% roasted pumpkin seed flour)

Table 4 : Proximate composition of pumpkin seed supplemented products

Treatments	Moisture (%)	Protein(%)	Fat (%)	Fibre (%)	Ash (%)	CHO (g)	Energy(Kcal)
Laddoo							
Control	2.82^{a}±0.006	09.97^{c}±0.006	27.65^{c}±0.006	1.69^{c}±0.006	1.41^{c}±0.006	56.46	514.57
Accepted (Raw)	2.28^{b}±0.006	11.72^{b}±0.006	31.55^{b}±0.006	3.21^{a}±0.006	2.46^{a}±0.006	51.22	535.71
T_2-30% supplementation							
Accepted (Roasted)	1.96^{c}±0.006	12.07^{a}±0.006	32.40^{a}±0.006	3.18^{b}±0.006	2.33^{b}±0.006	51.94	547.64
T_5-30% supplementation							
Panjeeri							
Control	2.76^{a}±0.006	6.05^{c}±0.006	26.82^{c}±0.006	1.55^{b}±0.006	1.46^{c}±0.006	61.36	511.02
Accepted (Raw)	2.62^{b}±0.006	8.97^{b}±0.006	31.57^{b}±0.006	3.16^{a}±0.006	2.55^{a}±0.006	51.13	524.53
T_2-30% supplementation							
Accepted (Roasted)	2.12^{c}±0.006	9.11^{a}±0.006	31.88^{a}±0.006	3.15^{a}±0.006	2.41^{b}±0.006	51.33	528.68
T_5-30% supplementation							
Mathi							
Control	2.02^{a}±0.006	6.22^{c}±0.006	40.31^{c}±0.006	0.22^{c}±0.006	0.38^{c}±0.006	50.85	591.07
Accepted (Raw)	1.89^{b}±0.006	9.09^{b}±0.006	45.52^{b}±0.006	2.08^{a}±0.006	1.93^{a}±0.006	39.49	604.00
T_2-30% supplementation							
Accepted (Roasted)	1.52^{c}±0.006	9.67^{a}±0.006	45.56^{a}±0.006	2.04^{b}±0.006	1.69^{b}±0.006	39.52	606.80
T_5-30% supplementation							

Values are expressed as Mean±SE

Means with different notation (a, b and c) indicates significant difference at 5% level of significance

treatments *i.e.* 1.89 and 1.52%. Protein content was also significantly higher in T_5 treatment (9.67%) and T_2 treatment (9.09%) than the control sample (6.22%). There was a significant increase in the fat content of both T_2 and T_5 treatments *i.e.* 45.52 and 45.56% from the control sample whose fat content was 40.31%. Fibre content of T_2 treatment was 2.08% which was more than the T_5 treatment whereas control sample had significantly lower fibre content *i.e.* 0.22%. Ash content of control sample (0.38%) was significantly lower than the T_2 treatment (1.93%) followed by T_5 treatment (1.69%). Carbohydrate content was observed more in control sample as 50.85 g than the T_2 and T_5 treatments *i.e.* 39.49 and 39.52 g. Energy content of T_5 treatment was maximum as 606.80 Kcal followed by the T_2 treatment with 604.00 Kcal whereas control sample had least calories *i.e.* 591.07 Kcal. Thus it was observed that the supplementation of raw or roasted pumpkin seed flour in the *Mathi* increased the nutritional content as compared to the control *Mathi* made from refined wheat flour only. Kaur and Kochhar (2014) evaluated the nutritional value of mathi supplemented with 25% potato flour and found that it provides 3.93% moisture, 6.44% protein, 35.93% fat, 1.28% fibre and 1.35% ash which were higher than the control mathi except protein *i.e.* 3.43% moisture, 6.52% protein, 35.20% fat, 0.46% fibre and 1.27% ash. Dhanesh (2016) analyzed the proximate composition of control mathi and mathi supplemented with 10% defatted peanut flour and 1% fenugreek leaf powder. Results revealed that the moisture, protein, fat, fibre, ash, carbohydrates, energy content of control and supplemented mathi was 3.32 and 3.44%, 11.59 and 16.58%, 18.86 and 20.92%, 0.23 and 1.43%, 0.48 and 0.88%, 65.52 and 57.18%, 477.67 and 483.56 Kcal.

Mineral content of pumpkin seed flour supplemented products :

Mineral *i.e.* iron and zinc content of all three products is presented in Table 5.

Iron :

Results revealed that the iron content of all the supplemented products was higher than their control samples. In *Laddoo*, it was found 3.09 mg in T_2 treatment (30% raw pumpkin seed flour), 2.93 mg in T_5 treatment (30% roasted pumpkin seed flour) and 2.36 mg in control sample made from bengal gram flour. In *Panjeeri*, iron content of T_2 treatment *i.e.* 3.29 mg was higher than the T_5 treatment *i.e.* 3.11 mg followed by control sample made of whole wheat flour with 2.15 mg. Iron content of *mathi*was again maximum in T_2 treatment (2.71 mg) followed by T_5 treatment (2.50 mg) whereas control had minimum content (1.38 mg) as it was made from refined wheat flour. 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/100g. Thus iron content of all the products significantly increased with the supplementation of raw and roasted pumpkin seed flour. Further it was observed that the maximum iron concentration was in the products supplemented with raw pumpkin seed flour at the level of 30% incorporation.

Table 5 : Mineral content of pumpkin seed supplemented products

Treatments	Iron (mg/100g)	Zinc (mg/100g)
Laddoo		
Control	2.36^{c}±0.006	1.18^{c}±0.006
Accepted (Raw)T_2-30% supplementation	3.09^{a}±0.006	2.08^{a}±0.006
Accepted (Roasted)T_5-30% supplementation	2.93^{b}±0.006	2.04^{b}±0.006
Panjeeri		
Control	2.15^{c}±0.006	1.02^{c}±0.006
Accepted (Raw)T_2-30% supplementation	3.29^{a}±0.006	1.95^{a}±0.006
Accepted (Roasted)T_5-30% supplementation	3.11^{b}±0.006	1.91^{b}±0.006
Mathi		
Control	1.38^{c}±0.006	0.32^{c}±0.006
Accepted (Raw)T_2-30% supplementation	2.71^{a}±0.006	1.51^{a}±0.006
Accepted (Roasted)T_5-30% supplementation	2.50^{b}±0.006	1.45^{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

Zinc :

From the results, it was found that the zinc content of the products supplemented with raw and roasted pumpkin seed flour was as followed : *Laddoo* 2.08 and 2.04 mg, *Panjeeri* 1.95 and 1.91 mg, *Mathi* 1.51 and 1.45 mg. Abd El-Ghany *et al.* (2010) analyzed the mineral content of pumpkin seeds and reported that the zinc content of seeds as 7.99 mg/100g. Thus zinc content of all the products significantly increased with the supplementation of raw and roasted pumpkin seed flour as compared to the control with 0% supplementation. Further it was observed that the maximum zinc content was in the products supplemented with raw pumpkin seed flour at 30% level of incorporation followed by products supplemented with roasted pumpkin seed flour.

Antioxidant compounds and peroxide value of pumpkin seed supplemented products :

Antioxidant compounds and peroxide value of all three products is presented in Table 6.

Total carotenoid content :

From the results, it is observed that carotenoid content of all the products are significantly different. *Laddoo* was found to be the product with maximum TCC among all the three products whereas *Mathi* contained minimum total carotenoid content. TCC of accepted products *i.e. Laddoo*, *Panjeeri* and *Mathi* supplemented with raw and roasted flour was 0.370 and 0.320 mg, 0.280 and 0.220 mg, 0.120 and 0.090 mg/100g. Control samples of each product was lower than the supplemented. Thus the total carotenoid content of all the products supplemented with pumpkin seed flour whether in raw or roasted form showed an increase as compared to the control sample of each product. Kim *et al.* (2012) found that the pumpkin seeds of *Cucurbita moschata* variety contained 7.15 mg/kg β-carotene.

Total antioxidant activity :

In *Laddoo*, TAA of 30% raw pumpkin seed flour supplemented *Laddoo* was 74.20% which was quite higher than the 30% roasted pumpkin seed flour supplemented *Laddoo* and control *Laddoo* made of bengal gram flour *i.e.* 69.90% and 63.70%. In *Panjeeri*, total antioxidant activity of T_2 treatment (30% raw pumpkin seed flour), T_5 treatment (30% roasted pumpkin seed flour) and control (whole wheat flour) were 63.50%, 61.30% and 53.80%. TAA of T_2 (30% raw pumpkin seed flour) and T_5 (30% roasted pumpkin seed flour) *Mathi* was higher *i.e.* 61.30% and 59.10% than the control

Table 6 : Antioxidant compounds and peroxide value in pumpkin seed supplemented products

Treatments	Total carotenoid content (mg/100g)	Total antioxidant activity (%)	Peroxide value (meq/kg)
Laddoo			
Control	0.200^{c}±0.0006	63.70^{c}±0.006	4.2^{a}±0.06
Accepted (Raw)	0.370^{a}±0.0006	74.20^{a}±0.006	4.0^{a}±0.58
T_2-30% supplementation			
Accepted (Roasted)	0.320^{b}±0.0006	69.90^{b}±0.006	3.2^{a}±0.06
T_5-30% supplementation			
Panjeeri			
Control	0.090^{c}±0.0006	53.80^{c}±0.006	2.8^{a}±0.06
Accepted (Raw)	0.280^{a}±0.0006	63.50^{a}±0.006	2.5^{b}±0.06
T_2-30% supplementation			
Accepted (Roasted)	0.220^{b}±0.0006	61.30^{b}±0.006	2.1^{c}±0.06
T_5-30% supplementation			
Mathi			
Control	0.003^{c}±0.0006	54.80^{c}±0.006	8.9^{a}±0.06
Accepted (Raw)	0.120^{a}±0.0006	61.30^{a}±0.006	6.7^{b}±0.06
T_2-30% supplementation			
Accepted (Roasted)	0.090^{b}±0.0006	59.10^{b}±0.006	6.3^{c}±0.06
T_5-30% supplementation			

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

sample (refined wheat flour) *i.e.* 54.80%. Thus total antioxidant activity was found higher in the products supplemented with raw pumpkin seed flour followed by the products supplemented with roasted pumpkin seed flour whereas control sample of all the products had comparatively less TAA. Nyam *et al.* (2013) found that DPPH radical scavenging activity of pumpkin seeds is 36.97%. They 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 products *i.e. Laddoo, Panjeeri, Mathi* was 4.0 and 4.2 meq/kg, 2.5 and 2.1 meq/kg, 6.7 and 6.3 meq/kg, respectively. Control samples of all the products had significantly higher peroxide value than the treatment samples *i.e.* products 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 :

Malnutrition and anemia imposes high cost on society. From this study, it was found that upto 30% supplementation of raw or roasted pumpkin seed flour in food products (*Laddoo, Panjeeri* and *Mathi*) was acceptable. Products supplemented with pumpkin seed flour (raw or roasted) have significantly higher content of protein, fat, fibre, iron, zinc as compared to the control samples (0% supplementation). Total carotenoid content, antioxidant activity was also found higher in pumpkin seed supplemented products than the control sample. Peroxide value was found higher in control sample than the supplemented products. 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 combat malnutrition and anaemia. These products can also become a part of the supplementary feeding programmes. Keeping in view the economic and nutritional benefits of pumpkin seeds, these products can be popularized among the communities and as for its nutritional value, it can be recommended to food industries to incorporate pumpkin seed flour in their products to improve the nutritional value.

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