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EFFECT OF DRIED PUMPKIN PULP AND SEED POWDER ON PHYSICAL, CHEMICAL AND SENSORY PROPERTIES OF BISCUITS

Agricultural Science

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ABSTRACT

Pumpkin pulp and seed (*Cucurbita maxima*) powder at 1:1 ratio blended biscuits were prepared by substituting refined wheat flour at 5, 10 and 15%. In organoleptic evaluation, 5% pumpkin pulp and seed powder incorporated biscuits received highest scores for the appearance, colour, aroma, taste, texture and overall acceptability. Physical characteristics of 5% pumpkin pulp and seed powder incorporated biscuits exhibited significantly reduced dough raising capacity (84.28%) and baking loss (28.10%) compared to control. Spread ratio was 19.66 and hardness of biscuits was reduced significantly (6.57N) compared to control (12.44N). Nutrient composition of 5% pumpkin pulp and seed powder incorporated biscuits was 4.80% moisture, 1.60% ash, 6.56% crude protein, 0.90% crude fiber, 20.66% crude fat, 66% carbohydrate, 0.95mg/100g beta-carotene, 0.95mg/100g zinc and 2.54mg/100g iron.

KEYWORDS

Cucurbita maxima, Organoleptic evaluation, Nutrient composition, Physical characteristics

INTRODUCTION

Pumpkin belongs to the *cucurbitaceae* family generally characterized by climbing herbaceous vine with tendrils and it is grown widely all over the world. Pumpkin has been used traditionally in many countries such as India, Mexico, Brazil, America and Argentina (Jia et al., 2003). β carotene is a precursor of vitamin A and it plays vital role in prevention of cancer and chronic diseases due to its antioxidant activity (Blumberg, 1995). Pumpkin (Cucurbita maxima) flesh and seeds are rich in vitamins, proteins, minerals and antioxidants (β carotene and tocopherols) (Kim et al., 2012). In addition to nutrient composition, it is composed of various biological active components such as polysaccharides, protein, peptide, sterols and para- amino benzoic acids (Adams et al., 2011). These biological active components have shown to be wide range of medicinal properties such as anti-diabetic activity, antioxidant activity, anti-carcinogenic effect and anti-microbial effect (Yadav et al., 2010) and it has been investigated through a number of animal models, cell culture studies and clinical trials (Zhou et al., 2007).

With these beneficial effect of pumpkin, it can be incorporated into different value added products. In recent times, increased attention has been focussed on under-utilized indigenous crops, for example the pumpkin is useful in food industries in the formulation of value added products. Although there have been studies with biscuits formulations with pumpkin flour and seeds, no studies conducted from the pumpkin pulp and seed powder mixture. Therefore, objective of this study was to develop pumpkin pulp and seed powder (*Cucurbita maxima*) mixed biscuits and evaluation of its physical, chemical and sensory properties.

MATERIAL AND METHODS

Preparation of pumpkin mixture

Pumpkin (*Cucurbita maxima*) was procured from the local market in Bengaluru, peeled, seeds were removed and cleaned. Pulp was grated into small shreds and pre-treated with 0.1% citric acid solution for 15min. Pumpkin shreds and seeds were then oven dried at 60℃ for 18 hours. Dried pumpkin shreds and seeds were ground to fine powders at 1:1 (pumpkin mixture) ratio using a kitchen grinder, sieved and stored in a refrigerated (8^0C) condition for further use. Pumpkin mixture had moisture 9.60%, ash 4.60%, protein 17.24%, crude fiber 12.27%, fat 12.23%, and carbohydrates 44.06%.

Formulation of biscuits

Pumpkin pulp and seed powder mixture at 1:1 ratio was substituted at 5, 10 and 15% with refined wheat flour which is presented in table1. Other ingredients were mixed together and kneaded for 15min until it became a soft dough.It was then fermented at 30℃ for 3 hours. Fermented dough was sheeted to a 0.2cm thickness and cut into shapes and baked at 160℃ for 15min following cooling and then biscuits were stored in air tight container for further analysis.

Table 1: Formulation of biscuits with different variations of pumpkin mixture

Ingredients (g)	Control	Treatment 1	Treatment 2	Treatment 3
Refined wheat flour (g)	100	95	90	85
Pumpkin pulp powder (g)	-	2.5	5	7.5
Pumpkin seed powder (g)	-	2.5	5	7.5
Vegetable oil (g)	24	24	24	24
Yeast (g)	1	1	1	1
Salt (g)	1.5	1.5	1.5	1.5
Sugar (g)	1	1	1	1
Water (ml)	36	36	36	36

Treatment I- 5% pumpkin mixture
Treatment II- 10% pumpkin mixture
Treatment III- 15% pumpkin mixture

Organoleptic evaluation

Organoleptic evaluation was carried out by using semi trained members (n=20) from the Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bangalore, on 9-point hedonic scale (1-dislike extremely to 9- like extremely) for appearance, colour, aroma, taste, texture and overall acceptability

Physical and chemical characteristics of biscuits

Best accepted product from the sensory evaluation, was evaluated for the physical and chemical characteristics.

Physical characteristics of biscuits

Dough raising capacity

Dough raising capacity was according to the procedure described by Kandhari (1994) with slight modifications. Dough raising capacity was expressed as percentage.

$$\text{Dough raising capacity \%} = \frac{\text{Final level reading} - \text{Original level reading}}{\text{Original level reading}} \times 100$$

Baking loss

Baking loss was measured by the procedure described by Murugkar et al. (2015). Dough weight was recorded after kneading process (before fermenting) and total biscuits weight was measured after baking process followed by cooling. Weight loss (baking loss) was calculated

as follows.

$$\text{Baking loss} = \frac{\text{Weight of the dough} - \text{Weight of the biscuits}}{\text{Weight of the dough}} \times 100$$

Thickness and diameter of biscuits

Thickness and the diameter of biscuits were measured according to the procedure described by Baljeet et al. (2010). Biscuits thickness was determined by stacking six biscuits on top of each other and total height was measured. Average thickness was recorded dividing total height of the biscuits by no of biscuits. Dimeter of biscuits was measured as six biscuits were laid edge to edge on smooth surface and diameter was measured using a scale. Six biscuits were then rotated 90° angle and diameter was taken using a scale. Average diameter was recorded in millimetre.

Spread ratio of biscuits

Spread ratio of biscuits was calculated according to the procedure described by Murugkar et al. (2015).

$$\text{Spread ratio} = \frac{\text{Average diameter of biscuits}}{\text{Average thickness of biscuits}}$$

Textural properties of biscuits

Hardness of biscuits was measured according to the method described by Filipcev et al. (2011) with slight modification. Hardness test was carried out with 100kg load capacity at 25℃ of Centigrade with 0.05N force. Sample was placed on the center of the platform and punctured at five places on the biscuits with the "X" pattern using a 2mm cylinder probe with test speed of 0.5mm/s, pre-test speed 5mm/s and post speed test 5mm/s. Five samples were punctured from organoleptically accepted pumpkin mixture blended biscuits and control. Hardness was calculated from the penetration curve and expressed as force (N).

Nutrient analysis of biscuits

Moisture, ash, crude protein, crude fat and crude fiber were analysed according to the AOAC (1980). Carbohydrates was calculated by using difference method. Beta- carotene was analysed method described by Ranganna (2002) and absorbance was measured using UV visible spectrophotometer at 450nm (Model: V-5000, China). Iron and zinc were estimated by using atomic absorption spectrophotometer (Model: PerkinElmer-700, Japan). All chemicals used in the study were of analytical grade.

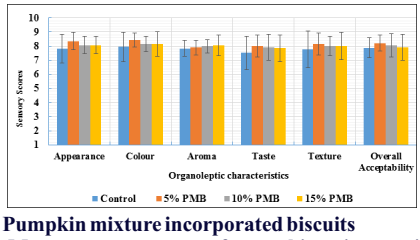
STATISTICALANALYSIS

Statistical analysis was performed through the statistical software SPSS 16.0. One-way ANOVA (Analysis of Variance) was used to determine the significant difference between treatment groups for sensory characters and mean comparison was performed using least significant difference (LSD). All analyses were set at 95% confidence level ($p<0.05$).

RESULTS AND DISCUSSION

Organoleptic evaluation of biscuits

No significant difference ($p<0.05$) was found between all the variations of pumpkin mixture incorporated biscuits and control. Five per cent pumpkin mixture incorporated biscuits received highest mean sensory score for the appearance (8.36), colour (8.43), taste (8.00), texture (8.14) and overall acceptability (8.21) compared to other incorporation levels (Figure 1). When increasing the proportion of pumpkin mixture, acceptability was gradually decreased. Therefore, 5% pumpkin mixture incorporated biscuits were best accepted by panalists.



PMB- Pumpkin mixture incorporated biscuits

Fig 1: Mean sensory scores of pumpkin mixtures incorporated biscuits Physical characteristics of biscuits

Physical characteristics of biscuits

Table 2 is represented the physical characteristics of 5% pumpkin mixture incorporated biscuits compared with control. Dough raising capacity was significantly reduced (84.28%) in 5% pumpkin mixture incorporated dough compared to control (97.13%). However, Dough rising level of 5% pumpkin mixture blended biscuits were more than the 80% of its original level which is considered as good raising capacity for bakery products (Kandhari, 1994). Significantly higher baking losses were observed in control biscuits (32.20%) compared to 5% pumpkin mixture incorporated biscuits (28.10 per cent). Baking losses occurs due to the evaporation of moisture during baking process. Lower baking loss can be ascribed to higher accessibility of water to flour resulting in less free water remaining in the biscuits, to be evaporated. Rodriguez-Garcia et al. (2012) reported lower baking loss is desirable for retaining its components and shape. Spread ratio is an important quality parameter and it correlates with mouth feel, texture, fineness of the biscuits (Murugkar et al., 2015). Biscuit's diameter, thickness and spread ratio were not significantly different from the control. But 5% pumpkin mixture blended biscuits had higher diameter, thickness and the spread ratio compared to control biscuits. Since thickness of pumpkin mixture incorporated biscuits was higher than the control biscuits, dough expansion was adequate. Hardness of pumpkin mixture supplemented biscuits (6.57N) was significantly reduced compared to control biscuits (12.44N) (Figure 2 and 3). Therefore, 5% pumpkin mixture blended crackers were softer than the control biscuits. Rozylo et al. (2014) reported increased hardness of pumpkin pulp powder (*Cucurbita maxima*) incorporated bread compared to control bread. Nyam et al. (2013) also reported increased hardness of pumpkin (*Cucurbita pepo*) seed and rind powder incorporated bread compared to control. This conflicting finding may be due to the changes of structure of biscuits with composite mixture of pumpkin pulp and seed powder.

Table 2: Physical characteristics of 5% pumpkin mixture blended biscuits

Products	Dough raising capacity (%)	Baking loss (%)	Diameter (mm)	Thickness (mm)	Spread ratio	Hardness (N)
Control biscuits	97.13± 0.71[a]	32.30± 1.54[a]	55.45± 0.01[a]	3.00±0.05[a]	19.03± 0.45[a]	12.44± 0.90[a]
5% PMB	84.28± 1.43[b]	28.10± 0.87[b]	59.00± 0.08[a]	3.20±0.00[a]	19.66± 0.33[a]	6.57± 0.44[b]

PMB- Pumpkin mixture biscuits, Different superscript letters in the same column indicates significant difference ($p<0.05$).

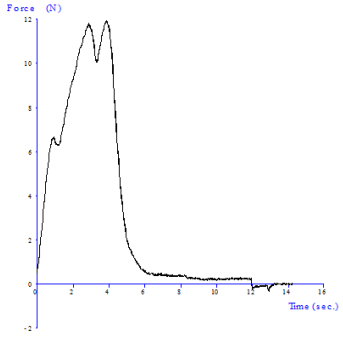


Fig 2: Curve for hardness of control biscuits

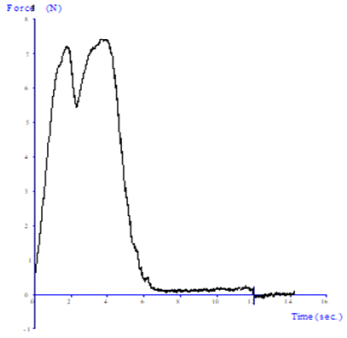


Fig 3: Curve for hardness of 5% pumpkin mixture blended biscuits

Nutrient composition of 5% pumpkin mixture blended biscuits

Nutrient composition of pumpkin mixture blended biscuits is

presented in table 3. Nutrient composition of 5% pumpkin mixture incorporated biscuits was significantly increased compared to control, except protein and fat content. Moisture, ash, protein, fat, crude fiber and carbohydrates were found to be 4.80g, 1.60g, 6.56g, 20.66g, 0.9g, 66.38g and 477.7kcal respectively. βcarotene content of 5% pumpkin mixture blended biscuits was 0.95mg/100g whereas control biscuits had 0.41mg/100g. Pumpkin mixture blended biscuits and control biscuits had zinc 0.87mg, 0.58mg and iron 2.54mg, 2.34mg/100g respectively.

Table 3: Nutrient composition of 5% pumpkin mixture incorporated biscuits

Parameters	Biscuits	
	Control	5% PMB
Moisture (g)	2.81±0.10[a]	4.80±0.02[b]
Ash (g)	1.01±0.005[a]	1.60±0.01[b]
Protein (g)	7.96±0.15[a]	6.56±0.43[a]
Fat (g)	20.01±0.87[a]	20.66±0.21[a]
Crude fiber (g)	0.39±0.53[a]	0.90±0.25[b]
Carbohydrate (g)	68.22±0.56[a]	66.38±0.39[b]
β carotene (mg)	0.41±0.01[a]	0.95±0.005[b]
Zinc (mg)	0.58±0.03[a]	0.87±0.005[b]
Iron (mg)	2.34±0.14[a]	2.54±0.09[b]

PMB- pumpkin mixture incorporated biscuits, Different superscript letters in the same raw indicates significant difference at 5%

CONCLUSION

Results revealed that pumpkin mixture blended biscuits had improved nutrient composition, textural and sensory properties. Therefore, it can be supplemented successfully into food products to enhance the nutrient content and this will be benefited in wide variety of food applications such as functional and therapeutic food products.

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