RESEARCH NOTE
J. Food Sci. Techol. Nepal, Vol. 9 (85-89), 2016
ISSN: 1816-0727

Effect of Mixing Pumpkin Puree with Wheat Flour on Physical, Nutritional and Sensory Characteristics of Biscuit

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Physical, nutritional and sensory quality characteristics of semi sweet type biscuit made by mixing wheat flour and pumpkin puree were studied. Wheat flour and pumpkin puree were mixed in the ratio of 100:0, 90:10, 80:20, 70:30 and 60:40. There was no significant decrease in diameter and thickness of biscuit; however bulk density increased as the amount of pumpkin increased. The nutritional quality of biscuit was positively influenced by the incorporation of pumpkin. Pumpkin increased protein, crude fibre, calcium, carotene and vitamin C of biscuit. The sensory quality of biscuit made from the mixed flour containing 70 parts of wheat flour and 30 parts of pumpkin puree was best. The biscuit made from the flour of this composition contained 2.53% moisture, 9.7% protein, 12% fat, 0.51% crude fiber, 0.81% total ash, 76.98% carbohydrate, 11.01 mg/100g carotene, 0.48 mg/100g Vitamin C, 1.88 mg/100g iron, 35.6 mg/100g calcium and energy value of 454.72 Kcal/100g dry matter.

Keywords: Physical characteristics, Nutritional composition, Sensory quality, Biscuit, Pumpkin

Introduction

Biscuit is a widely consumed and popular snack food. Attempts have been made to improve the nutritional quality of biscuit (Hooda and Jood, 2005 and Tyagi *et al.,* 2007). In the recent there have been attempts to improve the functional property of biscuit by using composite flour (Adebowale, 2012; Oyenika *et al.,* 2014; Kasaye and Jha, 2015). Functional property of biscuit can be improved by incorporating vegetables. Pumpkin, a member of the *Cucurbitaceae* family, is one of the largest families in the vegetable kingdom, consisting of largest number of edible plant species (Manjunath*et al.,* 2008).Pumpkin isan importantdietary source of fiber, carotene, minerals (copper, zinc, iron and magnesium) and vitamins(Loy and Broderick, 1990; Djutin, 1991). Despite this factthe potential of pumpkin in food service systemremains to be fully utilized (Nawirska *et al.*, 2012). Noor and Komathi (2009) investigated the potential of pumpkin flour as functional ingredient. This work is aimed to explore the possibility of pumpkin as an ingredient in the preparation of biscuit with improved functionality.

Materials and Methods

Ripe pumpkin fruit was obtained from the local market of Lalitpur. It was washed, peeled, seeds removed and cut in small pieces. The pieces of pumpkin were grinded in laboratory blender to smooth puree. Semi sweet type of biscuit was prepared using wheat flour, pumpkin puree and other biscuit ingredients. Five formulations were prepared by mixing wheat flour and pumpkin puree in the ratio of 100:0, 90:10, 80:20, 70:30 and 60:40 and coded as A, B, C, D and E respectively. The ingredients used in biscuit making and their amounts are shown in biscuit recipe (Table1).

First, fat, lecithin, non-fat milk powder (dairy whitener), pulverized sugar and pumpkin puree were mixed for about 3 min. To this leavening agents were added and mixed together for 3 min. This was mixed with wheat flour and kneaded for 10 min. The dough was laid for 15 min. The dough was sheeted and stamped out in circular shape having thickness of few mm and around 45mm diameter using a biscuit cutter. Baking was performed for 20 min at 180^0C temperature and biscuits were cooled.

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Table 1. Biscuit recipe

Ingredients	Amount (g)
Mixture of wheat flour and pumpkin puree	100
Sugar	19
Butter (Amul)	13
Salt	1
Dairy whitener (Everyday®)	1.5
Sodium bicarbonate	0.4
Ammonium bicarbonate	1.5
Water (ml)	25
Lecithin	0.26
Vanilla essence	0.05

The physical properties (thickness, diameter, spread ratio, bulk density) of biscuit samples were determined by the method of Baljeet et al., (2014). Proximate composition, calcium, iron, carotenoid and vitamin C were determined according to the Ranganna (2007). Food energy was calculated by multiplying the value of crude proteins, fat and carbohydrates by 4, 9 and 4 KCal respectively and results were expressed in KCal (FDA, 2004). Sensory test was performed by 9 point hedonic scoring test (9 = like extremely, 1 = dislike extremely) as per Ranganna, (2007) for colour, taste, texture, crispiness and overall acceptability for pumpkin biscuit. Data obtained were analyzed statistically by using analysis of variance (ANOVA) by statistical program known as Genstat release 7.22, Discovery edition, 2004, developed by VSN International Ltd. Sample means were compared by LSD method at 95% level of significance.

Results and Discussion

Chemical composition of wheat flour is found in many publications (Abu-Salem &Abou-Arab, 2011; Hasan *et al.*, 2012; Baljeet *et al.*, 2014). Chemical composition of pumpkin is also reported by many authors (Atef *et al.*, 2012; DFTQC, 2012; Bhat and Bhat, 2013). On dry weight basis the contents of protein, fat, crude fibre, iron and calcium were found higher in pumpkin than wheat flour as shown in Table 2. Wheat flour is considered not a good source of carotene and vitamin C.

Table 2. Chemical composition of pumpkin and wheat flour

Parameters	Pumpkin puree	Wheat flour
Moisture (%)	92.1± 0.25	13.01± 0.49
Crude protein (% db)	12.9 ±0.07[a]	11.88 ± 0.50[a]
Crude fat (% db)	1.77 ± 0.05[a]	1.26 ±0.08[a]
Crude fiber (% db)	9.49 ± 0.05[a]	0.44 ±0.09[b]
Total ash (% db)	7.5 ± 0.21[a]	0.61 ±0.06[b]
Carbohydrate (% db)	68.3 ±0.15[a]	85.77 ±2.5[b]
Iron (mg/100 gm dry matter)	5.18 ±0.15[a]	2.71 ±0.1[b]
Calcium (mg/100 gm dry matter)	115.6 ±2.35[a]	21.6±0.9[b]
Total carotene (mg/100g dry matter)	48.57 ±1.15	ND
Vitamin C (mg/100g dry matter)	1.91± 0.09	ND

db: dry basis, ND: not detected

*Values are means±standard deviation of triplicate sample

** Values with different superscript in same row are significantly different

Results (Table 3) show that the incorporation of pumpkin in wheat flour increased the content of protein, crude fibre, calcium, carotene and vitamin C as these were found to be in higher percent in pumpkin puree.

Table 3. Chemical composition and nutritional quality of biscuit

Parameters	A	B	C	D	E
Moisture (%)	2.57± 0.02	2.54 ±0.01	2.56± 0.01	2.53± 0.07	2.40 ±0.06
Crude protein (%db)	9.29± 0.02[a]	9.4 ±0.06[b]	9.51 ±0.08[b]	9.7 ±0.01[c]	9.9 ±0.04[d]
Crude fat (%db)	12 ±0.07[a]	11.95 ± 0.07[a]	11.9 ± 0.05[a]	12± 0.16[a]	11.9 ± 0.58[a]
Crude fiber (%db)	0.23± 0.03[a]	0.45 ±0.03[b]	0.48± 0.03[b]	0.51± 0.02[b]	0.55± 0.03[b]
Total ash (%db)	0.76± 0.170[a]	0.77± 0.09[a]	0.79± 0.06[a]	0.81± 0.03[a]	0.82± 0.07[a]
Carbohydrate (%db)	77.72 ±0.44[a]	77.43± 0.24[a]	77.32 ± 0.09[a]	76.98± 0.12[a]	76.83± 0.26[a]
Total carotene (mg/100g)	ND	2.38± 0.22[a]	5.13 ±0.76[b]	11.01± 0.87[c]	14.55± 0.3[d]
Vitamin C (mg/100g)	ND	0.14± 0.05[a]	0.22± 0.04[b]	0.48± 0.01[c]	0.78± 0.05[d]
Iron (mg/100g)	1.75± 0.15[a]	1.79±0.12[a]	1.83±0.18[a]	1.88±0.09[a]	1.91±0.08[a]
Calcium (mg/100g)	13.45± 0.39[a]	20.45±0.5[b]	26.4±0.1[c]	35.6±0.09[d]	44.1±0.8[e]
Energy(Kcl)	456.04± 1.53[a]	454.87± 3.20[a]	454.42 ± 0.3[a]	454.72 ± 1.12[a]	454.02± 1.53[a]

db: dry basis, ND: not determined

* Values are means±standard deviation of triplicate sample

** Values with different superscript in same row are significantly different

The results comply with the work of Baljeet *et al*. (2014) which showed increased crude fibre content in biscuit made with added carrot pomace powder. Similarly, Bhat and Bhat, (2013) reported increased β-carotene and crude fiber contents in cake due to the incorporation of pumpkin. Rogers *et al*., (1993) reveal 71.3% retention of β-carotene in freshly baked cookies. The loss of Vitamin C in potato due to baking was up to 28% (Streghtoff *et al*., 1946).

Table 4. Effect of incorporation of pumpkin puree on physical properties of biscuit

Wheat flour: pumpkin puree	Diameter(mm)	Thickness(mm)	Bulk density(g/cm)	Spread ratio (diameter/thickness)
A	48±8[a]	7.7±1.6[a]	0.40±0.4[a]	6.23±0.19[a]
B	46±5[a]	7.48±2.8[a]	0.48±0.6[ab]	6.15 ±0.22[a]
C	45±5[a]	6.93±2.6[a]	0.52±0.2[ab]	6.49 ±0.21[a]
D	44±6[a]	6.62±1.2[a]	0.62±0.4[b]	6.64±0.33[a]
E	41±6[a]	6.56±0.1[a]	0.88±0.5[c]	6.25±0.24[a]

* Values are means±standard deviation of triplicate sample

** Values with different superscript in same column are significantly different

The diameter and thickness of biscuits decreased as the proportion of pumpkin puree increased however there is no significant change. Increased proportions of pumpkin resulted in increasing bulk density however there was no significant change in spread ratio.

Jauharah *et al*., (2014) reported that there was no significant difference in diameter, thickness and spread ratio of biscuit up to 20% incorporation of corn powder. Similarly, Abu-Salem & Abou-Arab (2011) reported that there was increase in diameter and thickness of biscuit up to incorporation of 15% Bambara groundnut flour with no change in spread ratio. Difference in quality of protein and their water absorption characteristics may alter the water absorption capacity of flour and may alter the spread ratio (Slade and Levine, 1994).

The color of biscuit was better at levels of mixing proportions of 20 parts or more of pumpkin puree. Color development of baked products is caused by Maillard reactions between sugars and proteins (Lingnert, 1990). Others factors that might contribute to the color of final products were ingredients' composition, time of baking (Cronin and Preis, 2000). Hernandez-Ortega *et al*. (2013) report improved color of cookies with increase in the percentage of carrot pomace powder due to increase in caretenoids content. There was no difference in taste up to incorporation of 30 parts of pumpkin puree but 40 parts incorporation result in low sensory score compare to other which might be due to increase in polyphenol content resulting in bitter taste (Lesschaeve and Nobel, 2005). The overall acceptability was found better for biscuit prepared by incorporation up to 30 part pumpkin puree.

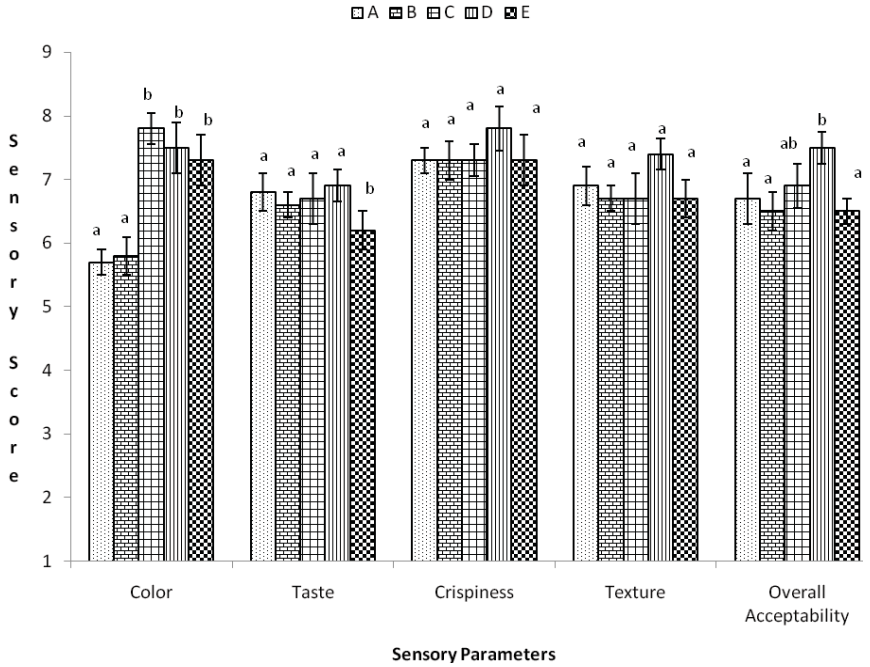

Figure 1. Sensory qualities of experimental biscuits prepared from different proportions of wheat flour and pumpkin puree

*Vertical error bars represents ± Standard Deviation of scores given by 15 panellists.
**Same alphabet at the top of the bars indicated not significantly different

Conclusions

Biscuit prepared by using wheat flour: pumpkin puree in the ratio of 70:30 was found to be the best in terms of sensory analysis. The spread ratio was same for all variation. However, the best sample was found to be richer in crude fiber, Vitamin C, Calcium content and carotene. This shows the ample possibility for incorporation of pumpkin puree in baked product.

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