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SENSORY AND NUTRITIONAL EVALUATION OF VALUE ADDED CAKES FORMULATED BY INCORPORATING BEETROOT POWDER

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ABSTRACT

Beetroots (*Beta vulgaris*) are rich in valuable, active compounds such as carotenoids, saponins, folates, betanin, polyphenols and flavonoids. Therefore, beetroot ingestion can be considered a factor in disease prevention. It also contributes to health because has antioxidants called betalains. Beetroot powder (BRP) was incorporated in cakes at 0, 10, 15, 20, and 25 per cent level. The sensory evaluation revealed that 70 per cent of the panelists liked extremely, the cake with 20 per cent BRP incorporation. Sensory evaluation using Score Card method showed that overall acceptability of cake with 20 per cent BRP was 9.15 out of 10 i.e. maximum. Nutritional evaluation of cakes revealed that as the level of BRP incorporation was increased from 0 to 25 per cent in cakes, crude protein, crude fat, crude fibre and total ash increased from 6.10 to 12.4%, 23.5 to 29.4%, 1.1 to 7.4%, 3.5 to 12.1 % respectively. Among minerals (mg/100g) i.e., iron, calcium, and phosphorus increased from 0.1 to 2.7, 32.0 to 64.0, and 310 to 532 respectively. Total Antioxidant Activity increased from 5.5 to 47% and Folic Acid from 0.24 to 1.9 mg/100g with the increase in BRP incorporation. Cake formulated using 20 per cent BRP had protein, fat, fibre, iron, calcium, folic acid and total antioxidant activity as 11%, 29.2%, 6.7%, 1.8 mg/100g, 52 mg/100g, 1.55 mg/100g, 29.4% respectively.

Keywords: Beetroot, beetroot powder (BRP), cake, nutritional evaluation, physical parameters.

INTRODUCTION

The demand of bakery products witnessed an incredible increase in the later part of 20th century. With rapid growth and changing eating habits of people, bakery products have gained popularity among masses. The sector, typically, constitutes cakes, breads and biscuits. Major contributing factors for this increase are urbanisation, increased demand for ready-to-eat products at reasonable costs, better shelf life, satisfying taste and ease of portability. The nutritional quality of these products is low because of the inferior nutritional composition of wheat grain per se. The flours and protein products of legumes, other cereals and tubers can be used effectively as vegetable protein and fibre sources for nutritional enrichment of these bakery products (Chavan and Kadam, 1993). The insufficiency of fibre, iron, calcium, antioxidant and folic acid in bakery products especially, in high sugar items such as cakes made of refined wheat flour needs a search for new natural nutrient rich source. India produces 205 million tonnes of fruits and vegetables annually. Most vegetables and fruits contain more than 80% water and therefore are highly perishable. Drying is one of the important post handling process of agricultural products and is the unique method. Beetroot is a popular root crop grown for its fleshy roots which are used as

cooked vegetable, salad and for pickling and canning. Beetroot is a rich source of potent nutrients and possess many health benefits but is a seasonal crop in India, due to its high moisture content one of the way of ensuring beetroot preservation is drying. To improve the red colour of tomato pastes, sauces, soups, desserts, jams, jellies, ice creams, sweets and breakfast cereals, fresh beetroot/beet powder or extracted pigments are used. Beetroot (*Beta vulgaris*) is an excellent source of calcium, iron, fiber, and folic acid. Beetroots are rich in valuable, active compounds such as carotenoids (Dias et al., 2009), glycine, betaine, saponins, betacyanines, folates (Jastrebova et al., 2003), betanin, polyphenols and flavonoids (Vali et al., 2007). Besides all these factors, the main reason behind supplementation of bakery products from beetroot powder is its exceptionally high nutrient content, and dietary fibre (especially soluble fibres). Beetroots have long been used for medicinal purposes, primarily for disorders of the liver as they help to stimulate the liver's detoxification process. It also contributes to consumer's health and wellbeing because it is known to have antioxidants because of the presence of nitrogen pigments called betalains. Keeping in view, the nutritional composition and seasonal availability of beetroot crop the present study was designed to formulate the cakes by

beetroot powder incorporation and to determine their sensory, physical characteristics and nutritional composition.

MATERIALS AND METHODS

PROCUREMENT OF RAW MATERIALS

Commercial beetroots, refined wheat flour and other ingredients were procured from the local market of Pantnagar.

PROCESSING OF BEETROOT POWDER

For processing, beetroots were first washed, peeled, and reduced to size (1 mm thick). They were dried in tray drier at 55°-60°C for about 11-12 hours. The dried beetroots were subjected to grinding in grinder. The ground material was passed through 60 mesh sieve and packed in dark air tight coloured bottles for further use.

PRODUCT FORMULATION

Beetroot cakes were prepared by substituting refined wheat flour with beetroot powder (BRP). Various blends were prepared using refined wheat flour and beetroot powder in the ratio of 100:0; 90:10; 85:15; 80:20; 75:25. The cakes were prepared by the method given in Phillip, (1965) with slight modifications. The ingredients used for the preparation of cakes were fat (100g) +sugar (100g) +egg (3 in no.)+ baking powder (1/2 tsp)+ sodium bicarbonate (1/4 tsp) + vanilla essence (few drops) per 100 grams of flour or blend .Cakes were baked at 160 °C for 25 minutes in a conventional oven which was pre-heated .

PHYSICAL PARAMETERS

Physical parameters were studied after cooling of cakes at room temperature .Weight of cakes was recorded in g. Volume was measured by the Rapeseed displacement method AACC(1969).Specific volume, volume index ,symmetry index ,uniformity index were measured by the method given in AACC (1969).

SENSORY CHARACTERISTICS

The sensory characteristics of cakes were judged by the panel of fifteen semi-trained members from the department of Foods and Nutrition .The panelists were asked to evaluate the product for different sensory attributes namely colour, flavour/taste, texture, appearance, aftertaste ,overall acceptability. Nine-point Hedonic Scale and Score Card method were used for evaluation of sensory characteristics of different cakes (Amerine *et al.*, 1965).

NUTRITIONAL COMPOSITION

Beetroot cakes were analyzed for proximate composition (AOAC,1995).The carbohydrate content was determined by subtracting the sum of the values (per 100 g) for moisture, total ash, crude fat, crude fibre and crude protein from hundred. The calorific value (Kcal per 100g) of sample was calculated by summing up the product of multiplication of per cent crude protein, crude fat and

carbohydrate present in the sample by 4, 9, and 4, respectively (Mudambi *et al.*, 1989). Among minerals, iron was estimated colorimetrically by Wong's method as quoted by (Ranganna 1986).Calcium content in cakes was estimated by titrimetric method, (AOAC (1995). Estimation of phosphorus was done by the method given by (Fiske and Subbarow 1925).The folic acid was estimated by the method given in (Ranganna 1986). Total Antioxidant activity was determined by the 1, 1-diphenyl-2-picryl-hydrazyl (DPPH) method of (Brand-Williams *et al.*1995).

RESULTS AND DISCUSSION

Beetroot cakes were prepared using different blends of refined wheat flour and beetroot powder. The acceptability of cakes was judged by the panel of fifteen semi-trained members. Sensory evaluation using Nine Point Hedonic Scale revealed that 70 per cent of panelists liked extremely the cake incorporated with 20 per cent of beetroot powder (Table 1).

Table 1: Sensory characteristics of beetroot powder incorporated cakes using Hedonic Scale

Nine Point Hedonic Scale	Cakes				
	Refined wheat flour:				
	Beetroot powder				
	100:0	90:10	85:15	80:20	75:25
Liked extremely	25 %	20%	15%	70%	0%
Liked very much	45%	50%	60%	20%	5%
Liked moderately	15%	30%	25%	10%	15%
Liked slightly	15%				20%
Neither like nor dislike					10%
Disliked slightly					30%
Disliked moderately					10%
Disliked Very much					0%
Disliked extremely					10%

Mean sensory scores with regard to colour, flavour, texture, and aftertaste decreased gradually as the level of beetroot powder was increased in cakes from 0 to 25 per cent. It was found that the sensory characteristics of cakes decreased gradually. While formulating the cakes it was observed that at 25 per cent level of beetroot powder incorporation, the crust of cake became hard, while the crumb grain became more compact and gummy. Gumminess is associated with dense, rubbery characteristics, which is not desirable in cakes (Grau *et al.*, 1999). There was significant difference in overall acceptability of cakes as the level of

BRP was increased from 0 to 25 per cent .However, upto 20 was recorded maximum i.e., 9.15(Table 2). per cent level of BRP incorporation the overall acceptability

Table 2: Mean sensory scores of beetroot powder incorporated cakes using Score Card method

Sensory attributes	Cakes							
	Refined wheat flour: Beetroot powder						CD at 5 %	S.Em.±
	100 : 0	90 : 10	85 : 15	80 : 20	75 : 25			
Colour	9.35 ±0.87	9.15 ± 0.67	9.0±0.68	8.95±0.82	8.5±1.10	0.53	0.20	
Flavour/Taste	9.20 ± 1.10	8.95 ± 0.68	8.80±0.89	8.60±1.09	6.25±1.55	0.69	0.26	
Texture	9.60 ± 0.59	9.45 ± 0.82	9.45±0.68	9.30±1.03	8.20±1.50	0.61	0.23	
Appearance	9.25 ± 1.16	9.15 ± 1.03	9.05±0.88	9.05±0.88	8.05±1.27	0.66	0.26	
Aftertaste	8.90 ± 0.64	8.75 ± 0.91	8.70±1.52	8.65±0.58	5.65±1.66	0.72	0.26	
Overall acceptability	9.05± 0.87	9.05 ± 1.16	9.10±1.10	9.15±1.18	5.90±1.55	0.66	0.28	

Average of 15 values reported

One way ANOVA (f test) was used to find out significant difference between samples (Snedecor and Cochran, 1967).

Data given in (Table 3) indicates that the weight of cakes was increased from 340 g to 380 g as the level of BRP incorporation was increased from 0 to 25 per cent. Volume and specific volume of cakes decreased gradually

as the level of BRP incorporation was increased from 0 to 25 per cent from 831cc to 593cc and 2.4 cc /g to 1.56 cc /g respectively.

Table 3: Physical characteristics of beetroot powder incorporated cakes

Physical parameters	Cakes				
	Refined wheat flour: Beetroot powder				
	100 : 0	90: 10	85 : 15	80 : 20	75 : 25
Weight(g)	340.0	350.0	362	370	380
Volume(cc)	831	772	712	650	593
Specific volume(cc/g)	2.4	2.2	1.96	1.75	1.56
Volume index	10.70	11.40	11.60	11.8	9.80
Symmetry index	1.9	1.70	1.50	1.25	0.58
Uniformity index	0.00	0.00	0.00	0.00	0.00

Decrease in volume of cakes may be due to decreasing level of gluten protein in the blend on

increasing amount of beetroot powder. Gluten imparts elasticity and strength to the dough (Hoseney *et al.*,1970).

Table 4: Nutritional composition of beetroot powder incorporated cakes

Nutritional Parameters	Cakes				
	Refined wheat flour: Beetroot powder				
	100:0	90:10	85:15	80:20	75 :25
Moisture (%)	6.80	7.30	7.90	8.10	10.20
Protein (%)	6.10	7.0	7.85	11.37	12.42
Fat (%)	23.5	25.6	27.9	29.28	29.49
Total ash (%)	3.50	4.17	4.50	7.08	12.18
Fiber (%)	1.12	2.56	5.50	6.70	7.40
Carbohydrate (%)	58.97	53.37	46.35	37.47	28.31
Energy(Kcal/100g)	471.78	473.48	587.9	458.88	428.3
Iron(mg/100g)	0.14	0.26	1.40	1.80	2.70
Calcium(mg/100g)	32.0	40.0	44.00	52.0	64.0
Phosphorus(mg/100g)	310.0	467.0	495.0	520.0	532.0
Folic acid(mg/100g)	0.24	0.91	1.25	1.58	1.91
Total antioxidant activity (%)	5.52	13.9	22.7	29.0	47.70

Nutritional evaluation of cakes revealed that protein content was increased from 6.10 to 12.42 (g/100g) as the level of BRP increased from 0 to 25 per cent. Fibre

content was increased from 1.12 to 7.40 (g/100g) with increase in BRP incorporation from 0 to 25 per cent. Iron

and calcium (mg/100g) content was increased from 0.14 to 2.70 and 32.0 to 52.0 respectively as the level of BRP incorporation increased from 0 to 25 per cent. Folic acid (mg/100g) was 0.24 in control cake which was increased to 1.58 as the level of BRP incorporation was increased to 20 per cent. Total antioxidant activity was increased from 5.52 to 29.0 per cent as the level of BRP was increased from 0 to 20 per cent. The same results were agreed by Nazni and Karuna Thara, (2011).

CONCLUSION

Beetroot is an interesting ingredient for the production of bakery and confectionery products, especially cakes and related products because, above all, its nutritive value (with high mineral content). Cake prepared with 20 per cent beetroot powder incorporation had better physical and sensory properties (colour, taste, texture). Therefore, it might be concluded that value added acceptable cakes can be formulated by incorporating BRP upto 20 per cent without affecting its quality adversely.

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