

# Nutritional Differences found in two values added backed products of beetroot (beta vulgaris)

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**Abstract**— Beetroot (Beta Vulgaris) is the very nutritious vegetable as it ranks 10th most powerful vegetable with respect to antioxidants and total phenolic compounds and it is rich in many valuable active compounds and nutrients. Therefore, consumption of beetroot can be considered a factor in disease prevention. The present study aimed at the formulation of two value added products of beetroot by baking i.e. beetroot cake by incorporation of beetroot powder (BRP) at 20 (Type-A), 30 (Type-B), 40 (Type-C) and 50 (Type-D) percent and beetroot biscuits were also prepared by incorporation of BRP at 0% (Type-A), 5% (Type-B), 10% (Type-C) and 15% (Type-D). The sensory evaluation of both backed products were done by using the Nine-point hedonic scale. The most acceptable beetroot cake and beetroot biscuits were nutritionally analyzed by applying the standard method of AOAC, 2000 for betanin, betaine, choline, folic acid, iron, vitamin C, potassium, phosphorus, magnesium, calcium, dietary fiber, carbohydrate and antinutrients (Saponins and Oxalic acid). The result obtained revealed that beetroot cake Type-C (40% of BRP) and beetroot biscuit Type-B (5% of BRP) were most acceptable than other. It was found that the value of all nutrients and antinutrients were increased from beetroot biscuits to beetroot cake but the amount of calcium, magnesium and potassium were decreased from biscuits to cake.

**KEYWORDS:** Beetroot, BRP, Vitamin C, Betanin, AOAC, Nine-Point Hedonic.

## I. INTRODUCTION

In the later part of 20th century the demand of backed products was increased very widely because the rapid growth and changing of eating habits of people due to shortage of time. In some country backed products are the integral part of meals but in India, it is not a staple food however it was generally eaten at the time of breakfast or hi-tea.

The most commonly used backed products are breads, cakes and biscuits. Beetroot is the taproot portion of the beet plant. It contains no fat, very few calories and excellent source of folic acid, fiber, calcium, iron, magnesium, sodium, potassium, vitamin B1, phosphorus and it also contains some vitamins such as vitamin A, vitamin B1, vitamin B2, vitamin B3 and choline. It also has some antinutrients such as oxalate and saponins. Beetroot is one of the few vegetables that contains highly bioactive pigment compound known as betaine and betanin. These compounds having anti-oxidative, hepatoprotective, anticancer and anti-inflammatory activity. Numerous studies have proved that ingestion of beetroot offers beneficial therapeutic effects which may improve the clinical outcomes for several pathologies, such as hypertension, type-2 diabetes, atherosclerosis and dementia. Foods which have high nutritive value having great importance for proper functioning of body system and also have their potential health benefits. As a result of value addition of beetroot to backed products the amount of antioxidants, dietary fiber, minerals and vitamins were

increased in backed products. So in this way the nutritional value of backed products was increased. Keeping this in view, the present study is planned to carry out the work on value addition of beetroot in backed products with the following objectives.

- ✓ To formulate two value added products of beetroot by backing i.e. beetroot cakes and beetroot biscuits.
- ✓ To identify the sensory evaluation of both backed products.
- ✓ To analyze nutritionally the most acceptable beetroot cake and beetroot biscuits.
- ✓ To find out the nutritional differences in both backed products.

## II. MATERIALS AND METHODS

### Materials Procurement

Beetroots which were organically grown in Ghala Farm, Hardoi Bypass Road, Lucknow, (U.P.) were used for making both backed products (Beetroot biscuits and Beetroot cake) but all other required ingredients like wheat flour, fat, sugar, backing powder, vanilla essence, curd, eggs and dry fruits were purchased from local market in Aminabad, Lucknow.

*Fig. 1. flow chart showing preparation of Beetroot Cake and Beetroot Biscuits*

**Preparation of Beetroot Powder**

Beetroot were firstly washed with clean running water, peeled and cut into small pieces. After that they were dried in a hot air circulated oven at 60 0C for 11-12 hours. After completed dryness the slices of beetroot were grindined by electric grinder. Then ground material were passed through 65 mesh sieve and finally it were packed in airtight coloured glass bottles for further use .1

**Products Formulation**

The four different types of beetroot cakes were prepared by using refined wheat flour and beetroot powder (BRP) in ratio of 100:0 (Type-A), 70:30 (Type -B), 60:40 (Type - C) and 50:50 (Type - D). While beetroot biscuits were also prepared in same maner by substituting wheat flour with BRP in the ratio of 100:0 (Type-A), 95:5(Type-B) , 90:10 (Type-C) and 85:15 (Type-D) . The flow Chart of preparation method of beetroot cake and beetroot biscuits were given in fig. 1.

**Sensory Evaluation**

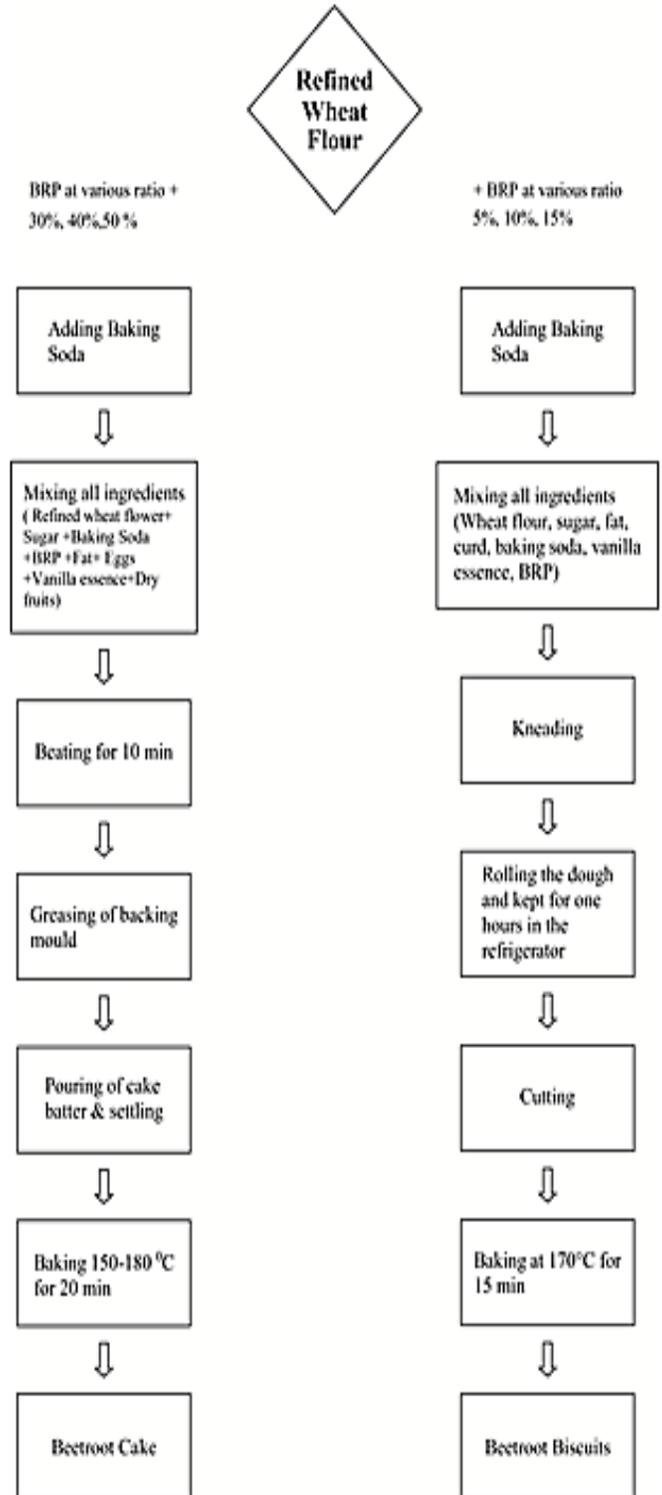
The sensory quality of beetroot cake samples and beetroot biscuits samples were evaluated by using Nine- Point Hedonic Scale with semitrained panel of ten members drawn from Babu Banarasi Das University, Lucknow and Era’s Lucknow Medical College and Hospital. The panelists were asked to evaluate the products for different sensory attributes namely colour , appearance , aroma , texture , taste and overall acceptability.

**Nutritional Composition**

The most acceptable beetroot cake and beetroot biscuits samples were nutritionally analyzed for betanin, betaine, choline, folic acid, iron, vitamin C, potassium, phosphorus, magnesium, calcium, fiber, carbohydrate and antinutrients (Saponins and oxalic acid) by applying standard method of AOAC (2000) .6

**Statistical Analysis**

The obtained data were subjected to statistical analysis summarized in the form of mean  $\bar{x}$  SD and finding out correlations among different parameters.7



### III. RESULT AND DISCUSSION

In this study two baked products were developed in which beetroot cakes were estimated [ Type-A (0% BRP), Type-B (30% BRP), Type-C (40% BRP) and Type-D (50% BRP)] for colour, appearance, aroma, texture, taste and overall acceptability scores of beetroot cakes were presented in (Table .1). It was obtained that the acceptability of beetroot cake Type-C (40% BRP) was highest among other preparations of beetroot cakes. The mean score of beetroot cake Type-C having highest scores in all sensory values then other three beetroot cakes (Type-A (0% BRP), Type-B (40% BRP) and Type -D (50% BRP)). The mean scores of highly acceptable beetroots cake color -  $7.60 \pm 0.516$ , appearance-  $7.60 \pm 0.516$ , aroma -  $7.70 \pm 0.483$ , texture -  $7.60 \pm 0.516$ , taste -  $7.90 \pm 0.316$  and overall acceptance -  $7.80 \pm 0.422$ . It was observed that while increasing the percentage of BRP above than 40 % the crust of cake become hard, although the crumb grain become more compact and gummy. While the gumminess characteristics of cakes are associated with dense and rubbery characteristics of cakes which is not desirable for cakes.

**Table .1 Sensory Evaluation Score of Beetroot Cakes**

Sensory Attributes	Type-A (0% BRP)	Type-B (30% BRP)	Type-C (40% BRP)	Type-D (50% BRP)]
Color	8.20 ± 0.632	7.00 ± 0.816	7.60 ± 0.516	6.30 ± 0.483
Appearance	8.50 ± 0.527	6.70 ± 0.483	7.60 ± 0.516	6.30 ± 0.483
Aroma	8.20 ± 0.789	6.90 ± 0.568	7.70 ± 0.483	6.20 ± 0.632
Texture	8.40 ± 0.516	6.80 ± 0.422	7.60 ± 0.516	6.10 ± 0.568
Taste	8.40 ± 0.516	6.80 ± 0.422	7.90 ± 0.316	6.10 ± 0.738
Overall acceptance	8.40 ± 0.516	6.80 ± 0.422	7.80 ± 0.422	6.10 ± 0.738

Beetroot biscuits were prepared by using different blends of refined wheat flour and beetroot powder. By mean scores of sensory attributes with regard to color, appearance, aroma, texture, taste and overall acceptance were decreased gradually as

the percentage of beetroot powder was increased in beetroot biscuits from 0 to 15 percentage. The sensory characteristics of beetroot biscuits were presented in Table .2.

**Table .2 Sensory Evaluation Score of Beetroot Biscuits**

Sensory Attributes	Type-A (0% BRP)	Type-B (5% BRP)	Type-C (10 %BRP)	Type-D (15% BRP)]
Color	9.05±0.686	8.65±0.747	6.50±0.946	5.10±0.718
Appearance	8.80±0.696	8.35±0.587	6.70±0.657	4.95±0.945
Aroma	8.95±0.686	8.35±0.587	6.85±0.813	5.00±0.725
Texture	8.80±0.696	8.10±0.718	6.70±0.733	5.40±0.883
Taste	9.10±0.641	8.15±0.671	6.60±0.754	4.90±0.788
Overall acceptance	8.90±0.641	8.25±0.550	6.65±0.671	5.05±0.999

It was found that the sensory characteristics of beetroot biscuits Type- B (5% BRP) were most acceptable among other formulation with different percentage of BRP. The mean score of highly acceptable beetroot biscuit Type- B (5% BRP) having color -  $8.65 \pm 0.745$ , appearance -  $8.35 \pm 0.587$ , aroma -  $8.35 \pm 0.587$ , texture -  $8.10 \pm 0.718$ , taste -  $8.15 \pm 0.671$  and Overall Acceptability -  $8.25 \pm 0.550$ . It was deducted that while increasing the percentage of BRP above than 5 % the texture of biscuits become harder and harder that is not desirable for biscuits and the color of biscuits becoming very dark that was not pleasant and the taste of biscuit was not good having some bitterness while increasing the BRP. On nutritionally analyzing both most acceptable backed products i.e. beetroot cake (Type-C (40% BRP) and beetroot biscuit (Type- B (5% BRP) by standard method of AOAC (2000) the values obtained were presented in table. 3

**Table .3 Nutritional Composition of Beetroot Cake and Beetroot Biscuits**

Nutritional Parameters	Units	Beetroot cake	Beetroot Biscuits
		Type-C	Type- B

		(40% BRP)	(5% BRP)
Betanin	mg/100g	66	40.02
Betaine	mg/100g	70.2	5.02
Choline	mg/100g	5.2	0.23
Folic acid	µg/100g	7.2	3.01
Iron	mg/gm	3020	2220
Vitamin C	mg/100g	5.1	4
Potassium	mg/100g	54.2	58
Phosphorus	mg/100g	47.25	13.2
Magnesium	mg/100g	30.35	140
Calcium	mg/gm	18200	54000
Fiber	gm/100g	4.2	2.85
Carbohydrate	gm/100g	84.2	77
Saponins	mg/100g	8.2	0.56
Oxalic acid	gm/100g	12.8	2.26

The data indicates that all analyzed nutrients and antinutrients were increased from beetroot biscuits to beetroot cake i.e. betanin (40.2 to 66) , betaine (5.02 to 70.2) , choline (0.23 to 5.2) , folic acid (3.01 to 7.2) , iron (2.22 to 3.02) , vitamin C (4 to 5.1) , phosphorus (13.2 to 47.25) , fiber (2.85 to 4.2) , carbohydrate (77 to 84.2) , saponins (0.56 to 8.2) and Oxalic acid (2.26 to 12.8) but the amount of calcium (54 to 18.2) , magnesium (140 to 30.35) and potassium (58 to 54.2) were decreased from beetroot biscuits to beetroot cake . The reason for increasing all the nutrients and antinutrients from beetroot cake to beetroot biscuits may be as followed that the beetroot cakes having higher percentage of BRP then beetroot biscuits and the content of these nutrients and antinutrients were high in beetroot. Although the content of potassium and magnesium was low in beetroot cake than beetroot biscuits it may be due to wheat flour having higher percentage of potassium and magnesium than beetroot. The content of calcium was higher in beetroot cakes than beetroot biscuits the reason may be as

followed. Due to addition of curd in beetroot biscuits instead of egg which was present in beetroot cake the amount of calcium was increased because curd have higher percentage of calcium than eggs and wheat flour also have higher percentage of calcium in cooperation to beetroot. So due to these reasons t it may be the amount of calcium was high in beetroot biscuits than beetroot cake.

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