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Standardization and development of Beet root powder incorporated food products with their quality evaluation

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Abstract

Beetroot is a traditional and popular vegetable in many parts of the world and also in India. It is especially rich in fiber as well as in sugar and has a moderate calorie value. It also has several compounds like betalains carotenoids and is a powerful dietary sources of nutrients. The objective of the present study was the development of beetroot powder (BRP) product and their quality evaluation. Beetroot powder was incorporated with wheat flour in different ratio i.e. 5:95(T1), 10:90 (T2), 15:85 (T3), 20:80 (T4), 25:75 (T5) and 30:70 (T6). Several preliminary trials were conducted to standardize beetroot powder and finally therefore T5 was found acceptable. Beet powder products (Poori and Halwa) were compared with the control and found that overall acceptability of beetroot was more than control. Fiber and Iron content was significantly higher in beetroot products compared to control.

Keywords: Beetroot; quality evaluation; standardize; acceptability.

1. Introduction

Beetroot scientifically known as *Beta vulgaris rubra* belongs to the chenopodiaceae family. It is the taproot portion of the beet plant. Beetroot has high amounts of nutrients present in it. In Hindi it is known as chakundar, Remolachas in Spanish and Hong cai tou in Chinese. Beetroot is a rich source of minerals like Magnesium, sodium potassium iron copper and manganese. It also consist a lot of antioxidants and vitamins like A B and C. It is a very good source of dietary fiber and natural dye. It also constitutes phenolic compounds which have antioxidant properties. Beetroot has many healthful benefits therefore in the recent years it has been considered as one of the most essential functional food. This colorful vegetable is not just used a food but also used a medicinal plant and a food colorant (Tadimalla, 2017) [5].

Beetroot (*Beta vulgaris rubra*) is an important raw material of plant origin with proven positive effects on the human body. They can be eaten raw, boiled, steamed and roasted. Red beetroot is a rich source of minerals (manganese, sodium, potassium, magnesium, and iron, copper). The fresh beetroots are exposed to spoilage due to their high moisture content and needs preservation. One of the preservation methods ensuring microbial safety of biological products is drying and dehydration (Mathlouthi, 2001) [2]. Dried beetroots can be consumed directly in the form of chips as a substitute to traditional snacks (Aro *et al.* 1998) [1], or after easy preparation as a component of instant food (Krejčova *et al.* 2007) [4]. Decreasing the moisture content of fresh foods to make them less perishable is a simple way to preserve these foods.

Inorganic nitrate present in the beet root helps in lowering the blood pressure and helps in reducing the risk of cardiovascular disease. As stated above nitrates in beetroot helps in lowering the rate of heart diseases and strokes. Beetroot helps in prevention of myocardial infection (obstruction of blood supply to a tissue in the heart).

Beetroot also helps in improving the delivery of oxygen to the working skeletal muscles. In case the skeletal muscles are not getting enough oxygen they are impaired and decreases the capacity to move arms or legs which leads to decrease in physical activity and eventually increasing the risk of heart disease. Hence seeking these positive properties of beetroot the present study was conducted to develop beetroot powder and its quality evaluation.

2. Materials and Methods**2.1. Procurement of raw materials**

Fresh Beet root and other ingredient wheat flour, sugar, salt, baking powder, baking soda, Butter, refined oil were procured and purchased in a single lot from the local market of Dostpur, Sultanpur.

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2.2. Processing of beetroot and development of powder

Beetroots were washed before peeling to remove dirt and unwanted material present. Beetroot were cut into small chips

before drying and beetroot chips were spread in a single layer on the drying sheet in a hot air oven and dried 60°C-70°C for 10 hours. Beetroot chips were milled by using grinder.



Plate 1: Processing and preparation of beetroot powder

2.2.3. Preparation of beet root products: Beetroot products (Poori and Halwa) were prepared by substituting wheat flour with beetroot powder. Various blends were prepared by using wheat flour and beetroot powder in ratio of 100:00; 95:05; 90:10; 85:15; 80:20; 75:25 and 70:30. The beetroot product were prepared using procedures as suggested in Figure and Table.

2.2.3 (a) Standardization of Poori: Beetroot Poori was prepared by replacing wheat flour with beetroot powder. Six type of Poori were developed by standard method of Poori preparation with slight modifications. All the ingredients used for the preparation of Poori were given in Table (1)

Table 1: Composition of Poori prepared By Using Beetroot powder

S. No.	Ingredients	Treatments						
		Control (T0)	T1	T2	T3	T4	T5	T6
1	Wheat flour	100g	95 g	90 g	85 g	80 g	75 g	70 g
2	Beetroot powder	00	5 g	10 g	15 g	20 g	25 g	30 g
3	Cumin seed	1 pinch	1 pinch	1pinch	1 pinch	1pinch	1pinch	1pinch
4	Water	40 ml	40 ml	40 ml	40 ml	40 ml	40 ml	40 ml
5	Refined oil	30 ml	30 ml	30 ml	30 ml	30 ml	30 ml	30 ml
6	Salt	1/8 tsp	1/8 tsp	1/8 tsp	1/8 tsp	1/8 tsp	1/8 tsp	1/8 tsp

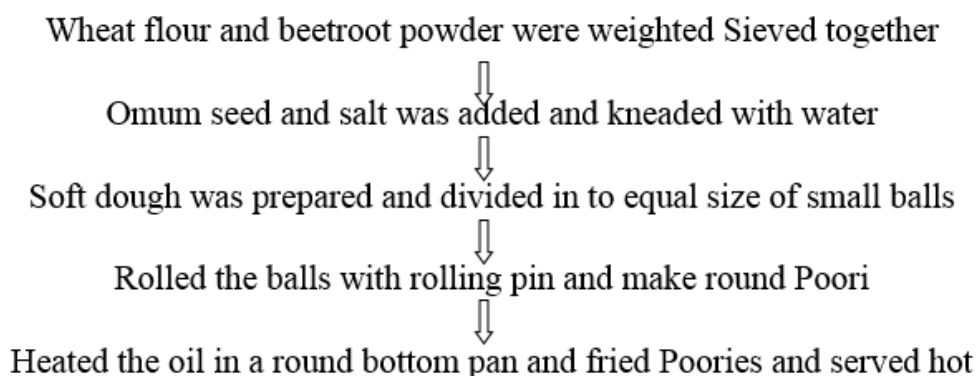


Fig 1: Flow diagram for poori preparation



Plate 2: Beetroot powder added poori

Standardization of Halwa: Beetroot Halwa was prepared by replacing wheat flour with beetroot powder. Six type of Halwa were developed by standard method of Halwa preparation with slight modifications. All the ingredients used for the preparation of Halwa were given in Table (2).

Table 2: Composition of Halwa prepared By Using Beetroot powder

S. No.	Ingredients	Treatment						
		Control (T0)	T1	T2	T3	T4	T5	T6
1	Wheat flour	100 g	95 g	90 g	85 g	80 g	75 g	70 g
2	Beetroot powder	00	5 g	10 g	15 g	20 g	25 g	30 g
3	Sugar	80 g	80 g	80 g	80 g	80 g	80 g	80 g
4	Refined oil	40 g	40 g	40 g	40 g	40 g	40 g	40 g
5	Water	80 ml	80 ml	80 ml	80 ml	80 ml	80 ml	80 ml

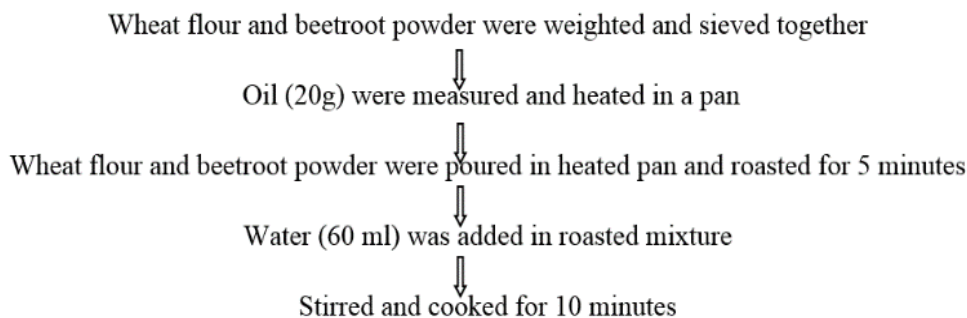


Fig 2: Flow Diagram for Halwa Preparation

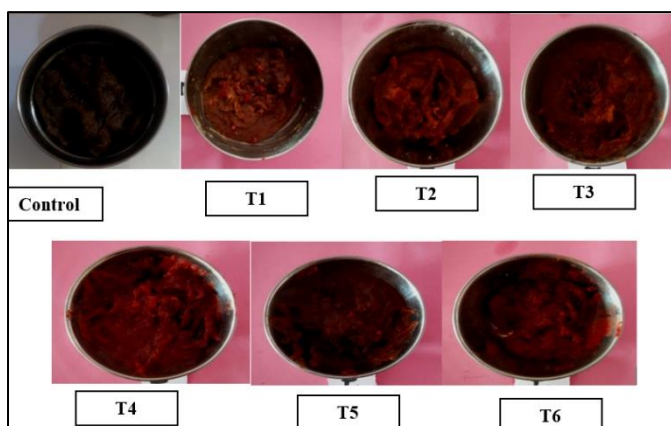


Plate 3: Beetroot powder added halwa

2.2.4. Sensory Characteristics

The sensory characteristics of products were judged by the panel of ten semi-trained member from the department of foods and Nutrition. The panelists were asked to evaluate the product for different sensory attributes namely colour, flavor, taste, texture, appearance, overall acceptability. Nine point Hedonic scale and score Card method were used for evaluation of sensory characteristics of different products (Amerine *et al.* 1965)

2.2.5. Nutrient Composition

Nutrients of developed products was calculated by using Nutritive value of Indian foods (NIN, 2007).

2.2.6 Statistical Analysis: The data were statistically analysed as Frequency Mean \pm SD and Analysis of Variance (ANOVA) was applied to determine the best acceptable ratio of products.

3. Results and Discussion

3.1. Sensory evaluation of beetroot powder products

3.1.1 Sensory evaluation of Poori

Result of sensory evaluation of the Poori prepared with 5, 10, 15, 20, 25 and 30 per cent incorporation of beetroot powder in wheat flour along with control is presented in Table 3. Scores were observed to be highest for all the sensory characteristics with an overall acceptability of 8.32 ± 0.07 suggesting that the control Poori was “liked very much” by the panel members. Among the treatments T5 *i.e.* 25 per cent level of incorporation Poori scored highest for all the sensory characteristics with an overall acceptability score 8.57 ± 0.17 when compared to other counterparts. Score of T5 8.53 ± 0.12 (colour), 8.43 ± 0.06 (flavour), 8.50 ± 0.17 (taste), 8.70 ± 0.25 (texture), 8.60 ± 0.00 (Appearance) and 8.57 ± 0.16 (over all acceptability) which were ranged “like moderately to like very much” have been scored.

Table 3: Mean Sensory Scores of Beetroot Powder Incorporated Poori Using Nine-Point Hedonic Scale.

Treatments	Colour Mean \pm SD	Flavour Mean \pm SD	Taste Mean \pm SD	Texture Mean \pm SD	Appearance Mean \pm SD	Overall Acceptability Mean \pm SD
T0 (control)	8.20 \pm 0.00	8.43 \pm 0.13	8.20 \pm 0.05	8.33 \pm 0.12	8.46 \pm 0.08	8.32 \pm 0.07
T1 (5%)	7.70 \pm 0.15	7.70 \pm 0.11	7.76 \pm 0.08	7.76 \pm 0.29	7.90 \pm 0.15	7.76 \pm 0.14
T2 (10%)	8.10 \pm 0.25	8.13 \pm 0.14	8.13 \pm 0.13	8.23 \pm 0.13	8.40 \pm 0.15	8.20 \pm 0.15
T3 (15%)	8.06 \pm 0.03	8.13 \pm 0.16	8.10 \pm 0.10	8.20 \pm 0.17	8.26 \pm 0.06	8.15 \pm 0.09
T4 (20%)	8.16 \pm 0.23	7.93 \pm 0.06	7.96 \pm 0.06	8.23 \pm 0.03	8.20 \pm 0.05	8.13 \pm 0.08
T5 (25%)	8.53 \pm 0.12	8.43 \pm 0.06	8.50 \pm 0.17	8.70 \pm 0.25	8.60 \pm 0.15	8.57 \pm 0.16
T6 (30%)	7.90 \pm 0.20	7.83 \pm 0.13	8.03 \pm 0.17	8.00 \pm 0.05	8.13 \pm 0.06	8.00 \pm 0.11
C.D.	N/A	0.378	0.374	N/A	0.347	0.378
C.V.	3.617	2.644	2.612	3.693	2.372	2.620

For the other entire sensory attribute decrease was noted in the score with increase in the level of addition of beetroot powder. The sensory score obtained in case of beetroot added Poori depicted that on overall basis control was liked very

much followed by T5, T4, T3, T2, T1, and T6, revealing that the addition of beetroot powder in Poori resulted in an increase in sensory scores up to 25 per cent incorporation level.

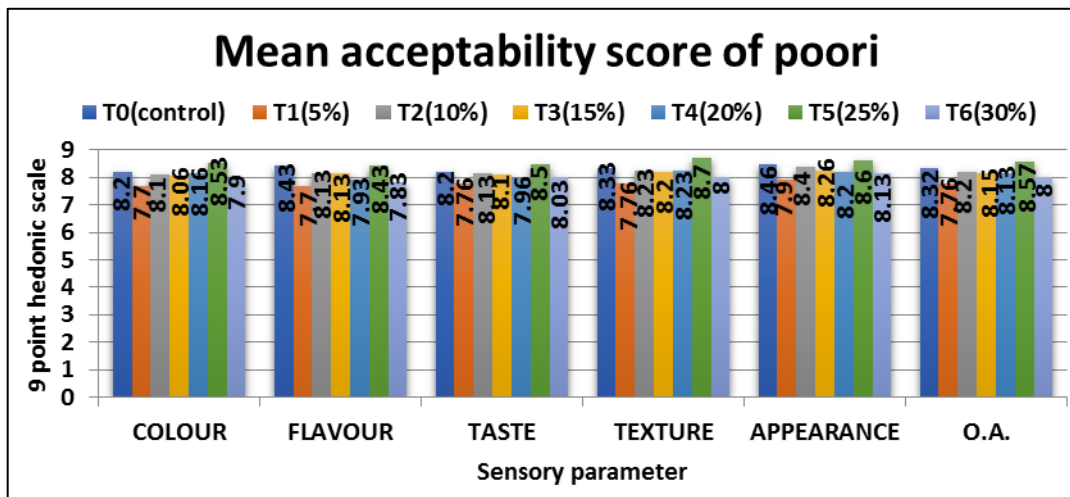


Fig 3: Sensory evaluation of beetroot powder added poori

3.1.2 Sensory evaluation of Halwa

Table 5 and Figure 5 shows the result of organoleptic evaluation of beetroot powder halwa at different levels. Sensory score revealed that the beetroot powder halwa fall under the category of “like very much” to “Like moderately”. Perusal for the sensory scores as evident for the Table 4 revealed that T5(25%) obtained highest score *i.e.* 8.53±0.12 for colour, 8.50±0.11 for flavor, 8.46±0.12 for taste, 8.50±0.05 for texture, 8.56±0.16 for appearance, and for

8.51±0.08 overall acceptability when compared to other counterparts. It also clear that from overall acceptability point of view T5 (25%) score the highest 8.51±0.08, 7.82±0.20 for T1(5%), 7.93±0.18 for T2(10%), 7.80±0.12 for T3(15%), 7.90±0.23 for T4(20%), 7.04±1.28 for T6(30%) respectively when compared to all other treatments. For all the other sensory attributes a decreased was noted in the score with increases in the level of ratio of beetroot powder the sensory scores ranged between like moderately to like very much.

Table 4: Mean Sensory Scores of Beetroot Powder Incorporated Halwa Using Nine-Point Hedonic Scale

Treatments	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Appearance Mean±SD	Overall Acceptability Mean±SD
T0 (control)	7.73±0.31	7.70±0.28	7.90±0.17	7.90±0.40	8.03±0.26	7.85±0.28
T1 (5%)	7.70±0.17	7.80±0.17	7.86±0.23	7.73±0.26	8.03±0.18	7.82±0.20
T2 (10%)	7.86±0.18	7.83±0.21	7.93±0.14	7.93±0.20	8.10±0.17	7.93±0.18
T3 (15%)	7.76±0.08	7.80±0.17	7.70±0.15	7.83±0.14	7.90±0.10	7.80±0.12
T4 (20%)	7.86±0.12	7.83±0.20	7.80±0.23	7.93±0.29	8.06±0.31	7.90±0.23
T5 (25%)	8.53±0.12	8.50±0.11	8.46±0.12	8.50±0.05	8.56±0.16	8.51±0.08
T6 (30%)	8.43±0.03	8.16±0.08	8.33±0.14	8.26±0.08	8.66±0.03	7.04±1.28
C.D.	0.522	N/A	N/A	N/A	N/A	N/A
C.V.	3.697	4.146	3.819	5.094	4.168	11.432

The sensory scores obtained in case of beetroot powder halwa depicted that on overall basis control was “Liked very much”. Followed by T5, T1, T2, T3, T4, than T6 revealing that ratio of beetroot powder increase in the sensory up to 25% ratio

level, but then the sensory scores continuously increase with T1, T2, T3, T4, and T6 decrease therefore T5 halwa of beetroot powder selected for further study.

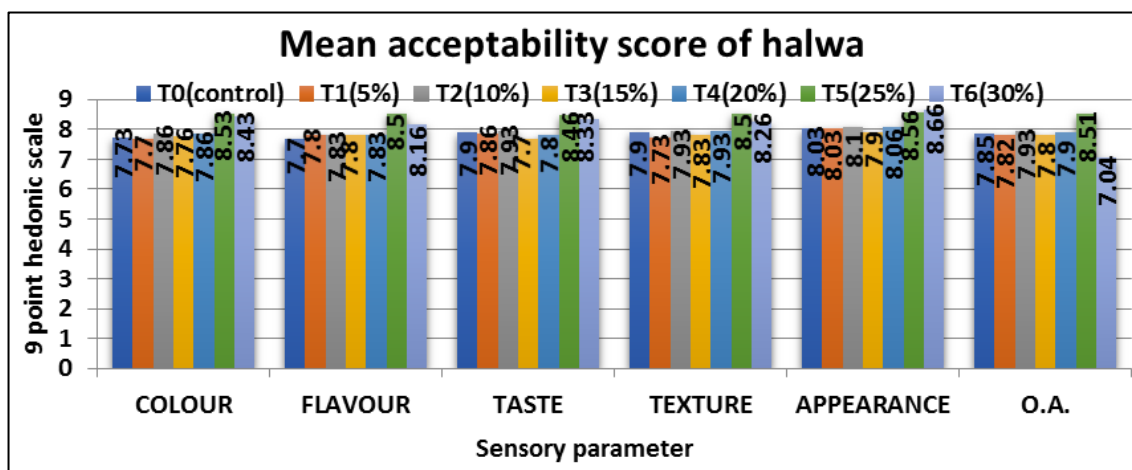


Fig 4: Sensory evaluation of beetroot powder added halwa

3.2. Nutrient Composition of Products

3.2.1 Nutritional Composition of beetroot powder incorporated Poori

Table 5. Poori was found to be containing 27.50 per cent of moisture in control and 28.75 per cent in beetroot powder added counterparts (Table 5). The ash content was 1.23 and 1.37 per cent (control and beetroot added) in Poori. Fibre content of control and beetroot powder added Poori was noted to be 1.86 and 2.22 per cent respectively and protein content of control and Beetroot powder added Poori was observed to be 9.38 10.50 and per cent respectively.

Fat content was observed 21.46 and 21.13 per cent for control and beetroot powder added Poori respectively. Carbohydrate content was found to be 37.45 for control and 37.21 per cent for beetroot powder added Poori. Energy value of control was observed 378 kcal 385 kcal and for beetroot powder added Poori. Iron content of control was observed to be 3.23 mg in

per cent 100 g. While in beetroot added Poori iron content was noted to be 4.13 mg in 100 g.

Table 5: Nutritional Composition of beetroot powder incorporated Poori

Nutrient constituents	Control	T5 (25%)
Moisture (g)	27.50	28.75
Protein(g)	9.38	10.50
Fat(g)	21.46	21.13
Ash (g)	1.23	1.31
Fibre (g)	1.86	2.22
CHO	37.45	37.21
Energy (kcal)	378	385
Calcium (mg)	40.75	40.80
Iron (mg)	3.23	4.10
Phosphorus (mg)	245.29	312.66

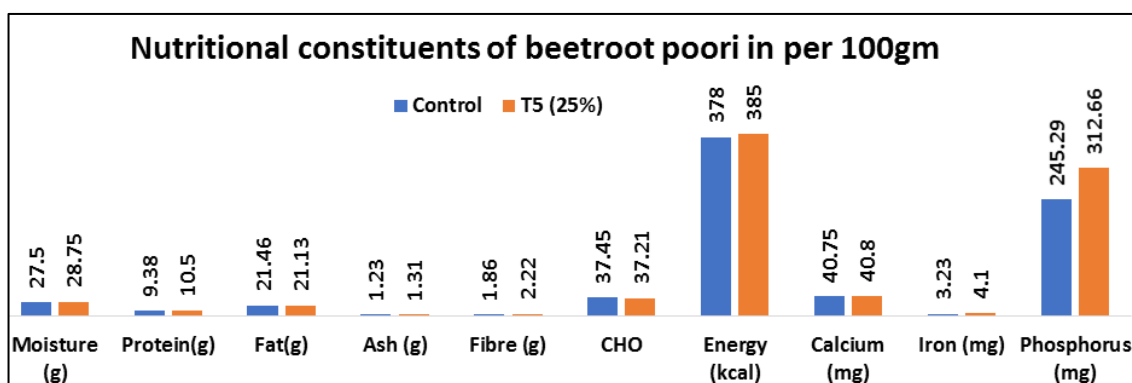


Fig 5: Nutrient composition of poori

3.2.2. Nutritional Composition of beetroot powder incorporated Halwa

The nutrient composition of control halwa was found to be 32.43 per cent moisture, 9.47 per cent protein, 21.52 per cent fat, 1.27 per cent ash, 1.86 per cent fiber, 32.28 per cent carbohydrate, 359 kcal energy, 42.48 mg calcium, 3.37 mg iron and 315.8 mg phosphorus content in per 100 g, whereas, beetroot powder added halwa was observed to contains 33.37 per cent moisture, 10.64 per cent protein, 21.17 per cent fat, 1.31 per cent ash, 2.25 per cent fiber, 32.43 per cent carbohydrate, 366kcal energy, 43.54 mg calcium, 4.21 per cent mg iron and 315.8 mg phosphorus content in per 100 g.

Table 6: Nutritional Composition of beetroot powder incorporated Halwa

Nutrient constituents	Control	T5 (25%)
Moisture (g)	32.43	33.37
Protein(g)	9.47	10.64
Fat(g)	21.52	21.17
Ash (g)	1.27	1.31
Fiber (g)	1.86	2.25
CHO	32.43	32.28
Energy (kcal)	359	366
Calcium (mg)	42.48	43.54
Iron (mg)	3.37	4.21
Phosphorus (mg)	246.12	315.8

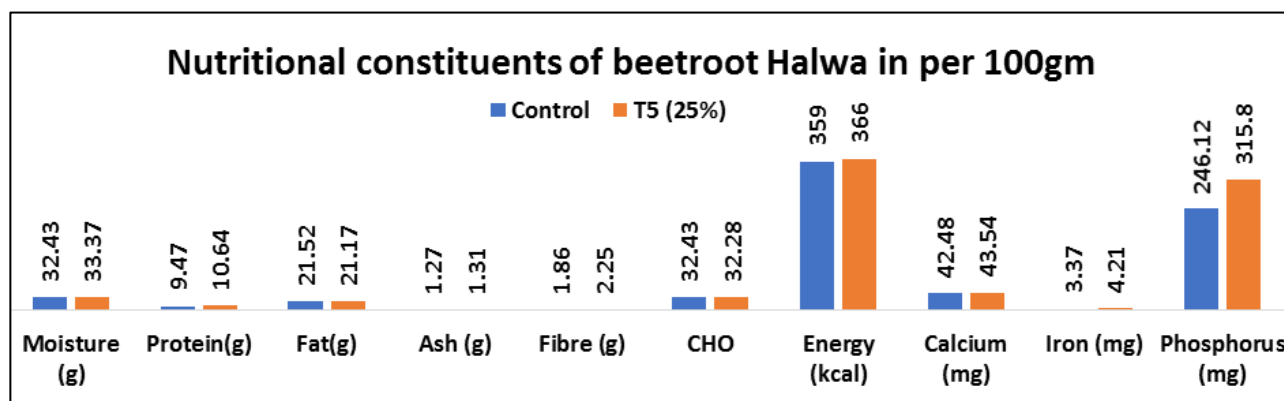


Fig 6: Nutrient composition of halwa

4. Conclusion

From this study it may be concluded that beetroot products prepared with 25 per cent beetroot powder incorporation had

better nutrient and sensory properties (colour, taste, texture etc.) and it also improved the nutritional profile over control products.

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