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Development of Beet Greens Incorporated Nutrient-Dense Product

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ABSTRACT

The present study was undertaken to develop a nutrient-dense product (ladoo) using beet greens. It was prepared with the addition of other ingredients such as Whole wheat, Bengal gram, Finger millet, White soybean, Beet greens, and Groundnut. All ingredients were procured from the local market. Whole wheat (25%), Bengal gram (20%), Finger millet (15%), White soybean (15%), groundnut (2%), and Beet greens (5%) were taken for the development of *ladoo*. Sensory evaluation of the prepared product was done by ten panels of judges. The prepared product with five grams of beet greens powder was highly acceptable. Nutritional analysis of the developed product found that energy (344.4kcal), carbohydrate (58.91g), protein (13.50g), fat (6.90 g), crude fiber (3.80g), iron (11.61mg) and calcium (652.14 mg). It can be concluded that Nutrient dense *ladoo* being good sources of energy, protein, iron and calcium should be included in the daily diet of vulnerable sections of the population. As per the sensory parameters of the developed product, the overall product score was significantly high and acceptable for consumption.

Key Words: Beet, Children, Greens, Nutrient, Population.

INTRODUCTION

Malnutrition is a major health issue in India. It silently destroys the future productivity of the nation. Thirty-six percent of children under the age of five years are stunted, nineteen percent are wasted, thirty-two percent are underweight and sixty-seven percent are anemic (NFHS-5, 2019-20). Beetroot (*Beta vulgaris* L.) belongs to the Chenopodiaceae family and is cultivated in the south and southeast regions (77% of the total produce). The annual yield is 30-40 t/ha, which accounts for an average production of 280 t (Amaral *et al,* 2004; Mello *et al,* 2008). Beet greens are more nutritious than their roots. They are rich in carbohydrates, protein, fiber, iron, potassium, magnesium, copper, calcium, vitamin A, vitamin B6, vitamin E, and vitamin C. They contain natural antioxidants (Biondo *et al,* 2014). Antioxidants inhibit the oxidation of fats and also neutralization of free radicles (Zheng and Wang, 2001), rich a source of iron than spinach (Joshi and Mathur, 2010). They are underutilized due to a lack of awareness of the nutritive value of their leaves (Biondo *et al,* 2014). The cultivation and consumption of underutilized vegetables help to reduce the nutritional deficiencies of the community and also help to improve the socio-economic status of the community. The present study was conducted to develop the beet greens incorporated nutrient dense product and compare the sensory parameters of the developed nutrient dense product (ladoo).

MATERIALS AND METHODS

An experimental research design was used for the present study. The research was carried out in the Food and Nutrition laboratory of Dayalbagh Educational Institute, Agra.

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Table 1. Preparation of control and experimental samples of Nutrient Dense Product.

Sr. No.	Ingredient	Control T0	Experimental sample		
			T1	T2	T3
	Whole wheat flour (gm)	30	25	25	30
	Bengal gram flour (gm)	20	20	25	30
	Finger millet flour (gm)	20	15	20	10
	Soybean (white) flour (gm)	20	15	15	10
	Groundnut (gm)	10	20	12.5	15
	Beet greens powder (gm)	-	5	2.5	5
	Total	100	100	100	100

Procurements of Ingredients

Nutrient-dense product was prepared by using whole wheat, finger millet, soybean white, bengal gram, jaggery, cardamom and refined oil which were procured from the local market of Agra. The fresh beet greens were collected from Dayalbagh Sabji Mandi, Agra without any cost. They were discarded and used for animal fodder.

Preparation of grains flour

The grains of whole wheat, finger millet, soybean (white), and Bengal gram (whole) were sorted, cleaned, washed and soaked. After soaking, all grains were kept for germination. Germinated grains and legumes were allowed for sun drying for 4-5 d. Dried ingredients were roasted for 5-10 minutes to reduce the moisture content. Roasting increases the aroma of the product. Roasted grains were ground to a fine powder in a stainless steel electric grinder. They were sieved and stored in air-tight containers for further use.

Preparation of beet greens powder

Beet greens were sorted and cleaned, thoroughly washed in running water to remove adhering dirt, spread on a cotton cloth for sun drying for 5-7 d, ground to a fine powder in a stainless steel electric grinder and sieved by using thin mesh. The dried leaves were packed in airtight container to incorporate into the nutrient dense product (ladoo).

Preparation of Groundnut powder

Groundnuts were cleaned and removed the foreign particles, roasted for till the groundnut become brown, ground in the electric grinder to make fine flour and sieved. The flour was kept in airtight container.

Preparation of Nutrient Dense Product (ladoo)

Prepared grains flour, beet greens powder and groundnut flour was added in required proportion. Jaggery and cardamom was added in the preparation of ladoo. Four samples were prepared to standardize the nutrient dense product . Three samples formulated with a combination of cereals, pulses, millets, and beet greens as experimental samples T1, T2, T3. One sample treated as control (T0) which was developed without incorporation of beet greens.

Sensory Evaluation

Sensory evaluation is a scientific method that helps to measure the human response to developed products. All the samples were tested by the ten panels of trained judges. Nutrient-dense product was evaluated for various sensory quality characteristics such as colour, flavour, taste, texture, appearance, and overall acceptability. Evaluation of the ladoo was done on the basis of 9 points hedonic scale.

Table 2. Hedonic scale and scores for organoleptic evaluation.

Sr. No.	Rating	Scores
	Liked extremely	9
	Liked very much	8
	Liked moderately	7
	Liked slightly	6
	Neither like nor dislike	5
	Dislike slightly	4
	Dislike moderately	3
	Dislike very much	2
	Dislike extremely	1

Nutrient Analysis of developed product

Nutrient analysis, *i.e.,* total ash, moisture, energy, protein, fat, carbohydrate, iron and calcium were analyzed for both control and experimental samples were determined by (A.O.A.C, 2007).

Statistical Analysis

Statistical analysis was carried out using appropriate statistical methods. Mean, standard deviation and 't' test were used.

RESULTS AND DISCUSSION

The data (Table 3) in the table show the analyzed nutritive values per 100 g of sample.

The moisture content in the control sample was less (16.32g) when compared with the experimental sample (19.05g). The experimental sample (2.45g) contained more ash than the control sample (1.09g). The energy value in the experimental sample (344.45kcal) was higher than the control sample (323.02kcal). The experimental sample (58.91g) had more carbohydrate value than the control sample (58.91g). The protein percentage in the control sample was 11.25 g, whereas, in the experimental sample, it was 13.50 g. The fat in the control sample was less (5.72g whereas in the experimental sample (6.90 g). The calcium content in the prepared experimental sample (652.14mg) was more than the control sample (423.22mg). The Iron content of the control and experimental samples were 5.04 mg and 6.90 mg, respectively. When compared to the control sample, the iron content was slightly more in the experimental sample, because of the addition of beet greens which are rich in iron. Kakade *et al* (2015) developed the beet greens incorporated product and found that beet greens enhanced the nutritive value of the product. Protein percentage is increased in the beet greens incorporated products.

The above table depicted the sensory parameters of the developed nutrient-dense product. According to appearance, the experimental sample (8.10) had more mean score than the control sample (5.10). It was evident by the t value (11.81) which was significant at (<0.05) level. This shows that developed nutrient dense product was highly acceptable with respect to appearance. The mean value of color in experimental sample (8.00) was high than the control sample (4.90) and obtained

Table 3. Nutrient analysis of Nutrient dense product.

Sr. No.	Test Parameter	Units of measurement	Control (T0)	Experimental (T1)
	Moisture	g/100g	16.32	19.05
	Total ash	g/100g	1.09	2.45
	Energy	Kcal/100g	323.02	344.45
	Carbohydrate	g/100g	55.62	58.91
	Protein	g/100g	11.25	13.50
	Total fat	g/100g	5.72	6.90
	Calcium	mg/100g	423.22	652.14
	Iron	mg/100g	5.04	11.61

Table 4. Sensory evaluation of Nutrient product (ladoo)

Sr. No.	Sensory Parameter		Mean	SD	t value	Significance level
1.	Appearance	Control	5.10	0.56	11.81	< 0.05
		Experimental	8.10	0.56		
2.	Color	Control	5.70	0.48	5.81	< 0.05
		Experimental	8.00	1.15		
3.	Texture	Control	4.90	0.56	6.66	< 0.05
		Experimental	7.10	0.87		
4.	Aroma	Control	5.60	1.34	2.49	. < 0.05
		Experimental	7.00	1.15		
5.	Taste	Control	4.90	0.73	7.61	< 0.05
		Experimental	8.00	1.05		
6.	Overall acceptability	Control	5.30	0.67	8.83	< 0.05
		Experimental	8.20	0.78		

t-value (5.81) was significant (<0.05). This proves that developed nutrient-dense product (ladoo) was highly acceptable by its color. As per the texture of the nutrient-dense product (ladoo), the experimental sample (7.10) had more mean score than the control sample (4.90) which revealed the obtained t value (6.66) was significant (<0.05). This reveals the developed product is good in texture. According to the sensory score of aroma, the experimental sample (7.00) obtained more mean value than the control sample (5.60) which is evident by the t value and found significant at (<0.05). This reveals the developed product is good and acceptable with respect to aroma. Taste of the nutrient-dense product scored high mean score in the experimental sample (8.00) than the control sample (4.90), obtained t value (7.61) indicated the findings which was significant at (<0.05) level. This proves that the developed product is highly acceptable by its taste. The overall acceptability of nutrient-dense product , the experimental sample (8.20) had more mean value than the control sample (5.30). It was evident by the t value which is significant at (<0.05). The overall product score was significantly high which is highly acceptable for consumption. It was observed that appearance, texture, colour, aroma,, taste and overall product sensory score nutrient dense product was remarkable in the experimental sample. Hence, the product proved to be highly acceptable for consumer consumption. This was similar to the study which was carried out by Gautham *et al* (2014), who analyzed the sensory qualities of the developed product sample by using the nine point hedonic scale. The result revealed that the processed composite flour (foxtail millet, wheat, chick pea) based products were significantly accepted at the level of <0.05 level.

CONCLUSION

It can be concluded that Nutrient dense product being good sources of energy, protein, iron and calcium should be included in the daily diet of vulnerable sections of the population. It fulfills the $3/4^{th}$ nutritional requirement of children. As per the sensory parameters of the developed product, the overall product score was significantly high which is highly acceptable for consumption.

REFERENCES

Amaral A S, Anghinoni I and Deschamps F C (2004). Resíduo de plantas de cobertura e mobilidade dos produtos da dissolução do calcário aplicado na superfície do solo. *Revista Brasileira de Ciência do Solo,* **28**(1), 115-123.

A.O.A.C. (2007). Official Methods of Analysis of the Association of Analytical Chemists. 16th Edition, Washington DC.

Biondo P B F, Boeing J S, Barizão É O, de Souza N E, Matsushita M, de Oliveira C C, Visentainer J V (2014). Evaluation of beetroot (*Beta vulgaris* L.) leaves during its developmental stages: A chemical composition study. *Food Sci and Technol* **34**(1), 94–101.

Gautham L, Chaturvedi N and Gupta A (2014). Development of micronutrients rich homemade extruded food products with the incorporated of processed foxtail millet, wheat and chickpea. *Indian J Community Health* **26**(02).

Joshi P and Mathur B (2010). Bioavailability of iron from the leaf powders of dehydrated less utilized green leafy vegetables. *Asian J Experi and Biological Sci* **1**(4), 845-854.

Kakade S B, Hathan B S and Vs N (2015). Utilization of Beetroot (*Beta vulgaris* L .) leaves powder in cereals based extruded product . *Int Res J Engineer and Technol* **2**(3), 2153–2161.

Mello D F, Franzolini R, Fernandes L B, Franco A V M and Alves T C (2008). Avaliação do resíduo de nabo forrageiro extraído da produção de biodiesel como suplemento para bovinos de corte em pastagens. *Revista Brasileira de Saúde e Produção Animal* **9**(1), 45-56.

National Family Health Survey- 5, 2019-20 (2020, 4 January) International Institute for Population Sciences, Mumbai, Ministry of Health and Family Welfare, Government of India. Retrieved from http://rchiips.org/NFHS/factsheet_NFHS-4.shtml.

Zheng W and Wang S Y (2001). Antioxidant activity and phenolic compounds in selected herbs. *J Agric and Food Chem* **49**(11), 5165-5170.

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