

DEVELOPMENT OF BEETROOT (*BETA VULGARIS*) BASED VALUE ADDED BEVERAGE: A REMARKABLE STEP TOWARDS UPLIFTMENT OF HUMAN HEALTH

BHAVANA, A.¹, SOUMYA HIREGOUDAR¹ AND AKSHAY R. PATIL²

¹Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bengaluru 560 065, Karnataka, India

²Food Science and Technology, NIFTEM-T, Thanjavur, Tamil Nadu, India

(Received 15 May, 2023; Accepted 7 July, 2023)

Key words: Beetroot, Dehydration, Value Addition, Beverage and Health Benefits.

Abstract–Beetroot belongs to the *Beta L. genus*, the *Betoideae* subfamily of the goosefoot family (*Amaranthaceae*). Beetroot (*Beta vulgaris*) is the very nutritious vegetable as it ranks 10th most powerful vegetable worldwide due to its high content of biologically active substances, such as betalains, inorganic nitrates, polyphenols, folates. The consumption of beetroot can be considered a factor in disease prevention and a boon to human health. As beetroot are perishable, processing it for dehydration and value added in ready to drink commodity would enhance the nutrition of all the age groups and creates sustainable food security. The present study on *Beetroot instant Khata Meeta Panna mix* (a king of drink) was undertaken by optimization of beetroot for dehydration process, development of *Beetroot instant Khata Meeta Panna mix* in different formulations (20%, 30% and 40%), sensory evaluation, nutritional analysis, storage study and cost estimation was conducted for the best accepted variation of the developed product. The sensory scores for appearance, colour, texture, flavour, taste and over acceptability was 8.52, 8.55, 7.56, 8.56 and 8.58 respectively, respectively. The scores for overall appearance were observed in the 'like very much' scale. The moisture 5.92 g, protein 7.17 g, fat 3.90 g, ash 1.99g, crude fibre 15.42 g, carbohydrates 12.03 g, energy 98.78Kcal. The values indicated that *Beetroot instant Khata Meeta Panna mix* is a very good source of nutrients for the normal growth and development of all the age groups. The total ash content of *Beetroot instant Khata Meeta Panna mix* in the present study was 1.99 g in which the calcium content was 26 mg, magnesium 29 mg and iron was 9.54 mg respectively. Cost of production for 100 g of convenience beverage was Rs. 14/-. It could be concluded that the results of this study clearly demonstrated the usefulness of supplementing *panna mix* with beetroot powder as a valuable food addition to enhance nutritional characteristics and technological quality of the beverage.

INTRODUCTION

The frantic rhythm of modern life and the increase in the number of people who live alone have determined changes in food preparation and in the habits of consumption. Less time is available for a cook to make food. In this consequence, the rapid progress of the ready-oven food technology and its products has to be mentioned. Dried drink mixes play an important role in the nutrition of people because they fulfill present and future social consumer requirements. Soup is a liquid which is prepared from vegetables, fish or meat using water, juice or stock and some thickening agents and

fall under heterogeneous category of food.

Usually there are two kinds of soups like thick soup and clear soup. Thick soups are prepared by mixing powder of cereal or pulse flour, cream and eggs. On the other hand, clear soups are made from clear extracts of plant parts and animal which are edible. Instant soup is almost ready to eat and take less time to cook. It has an important role for maintain nutrition of the people by covering a wide range of dried foods. There is a big demand of dry soup mixes in the global market. The advantages of the dehydrated foods, particularly, dry soup mixes could be as a protection from enzymatic and oxidative spoilage and flavor stability at room

^{1,2}Ph.D. Scholar

temperature over long periods of time (6 - 12 months). Also, they do not need refrigerator and had quite nutritive value, particularly as a source of protein. In addition, they are ready for reconstitution in a short time for working families, hotels, hospitals, restaurants and institutional use as well as to military rations.

Moreover, they exert light weight for shipping and availability at all time of the year. It is well known that the good quality and reasonable ratio of dehydrated soup depend on variety and functional properties of supplemented individuals. A balance of nutrients may be obtained by including whole cereals, vegetables, pulses and milk products, etc. Such these diets supply a large proportion of our energy needed, carbohydrate, protein, dietary fiber, amino acids and minerals. Also, functional ingredients can be easily incorporated into soup powders to provide health benefits. For example, cereal proteins are generally deficient in some essential amino acids, to augment the protein quality of cereal based foods, the concept of cereal-legume complementation by blending cereal and legume flour can be applied. Beetroot (*Beta vulgaris* L.) belongs to the Chenopodiaceae family. It has bright crimson colour. Beetroot is commonly known as beet, chard, spinach beet, sea beet, garden beet, white beet and Chukander (in Hindi). It has very medicinal properties which give some positive effect on the human body.

Beetroot can be eaten raw, boiled, steamed and roasted. Red beetroot is a rich source of minerals (magnesium, manganese, sodium, potassium, iron, copper). The beetroot has different medicinal properties and help to protect against heart disease and certain cancers (colon cancer). Beetroot belongs to the *Beta* L. genus, the *Betoideae* sub family of the goosefoot family (*Amaranthaceae*). Beetroot (*Beta vulgaris*) is the very nutritious vegetable as it ranks 10th most powerful vegetable worldwide due to its high content of biologically active substances, such as betalains, inorganic nitrates, polyphenols, folates. Beetroot are rich in other valuable compound such as glycine, betaine, saponins, betacyanin, carotenoids, folates, betanins, polyphenols and flavonoids. Beetroot contributes to consumer's health and well being because it has antioxidant property due to the presence of nitrogen pigment betalain. Beetroot are also known for its antimicrobial and antiviral effects (Strack *et al.*, 2003) and it can also inhibit the cell proliferation of human tumor cells.

Beetroot is one of the natural foods which boosts the energy as it has one of the highest nitrates and sugar contents plant. Beetroot makes an excellent dietary supplement as it is not only rich in minerals, vitamins and nutrients but it also has unique Phytochemical compounds (carotenoids, phenolic acids, ascorbic acid) which have many medicinal uses. Therefore, consumption of beetroot can be considered a factor in disease prevention and a boon to human health. As beetroot are perishable, processing it for dehydration and value added in ready to drink commodity would enhance the nutrition of all the age groups and creates sustainable food security. Henceforth, the present study on *Beetroot instant Khata Meeta Panna mix* was undertaken with the objectives like to optimize beetroot for dehydration process, develop *Beetroot instant Khata Meeta Panna mix*, to conduct sensory evaluation for the developed *Beetroot instant Khata Meeta Panna mix* and to conduct nutritional analysis and storage study for the best accepted variation of *Beetroot instant Khata Meeta Panna mix*.

MATERIALS AND METHODS

Procurement of the ingredients

Ingredients include beetroot, mint leaves, cumin, black pepper, salt, amchur powder, ginger powder and jaggery procured from the local market Bengaluru

Processing of ingredients

Processing of Beetroot

- Beetroot was cleaned by removing peel
- Cut it in slices and blanched for 5 min
- Dried in oven at 55 degree Celsius at 10 hours
- Dried beetroot was made it into powder and sieved in the BIS scientific sieve 70 mm size mesh.

Preparation of Spices Mix Powder

Jaggery (25%), Cumin powder (10 %), Amchur powder (10%), mint leaves powder (10%), ginger powder (10%) and salt (5%) were measured by electric balance and roasted. Then spices were ground by electric grinder to make spices mix. The ground spices mix powder was packed in LDPE bag and storage at room temperature.

Processing Yield Percentage

The beetroot *Beetroot instant Khata Meeta Panna mix* was weighed. The processing yield was calculated

from weight of each final products multiplied by 100 and divided by the weight of their precursor product. Three analytical replicates were performed for each treatment and mean value was calculated.

Development of *Beetroot instant Khata Meeta Panna mix*

Commercially available rasna mix was considered as control and 4 different variations of *Beetroot instant Khata Meeta Panna mix* was formulated.

Control (c): Rasna mix

- T1: Unblanched beetroot powder
- T2: Blanched beetroot powder
- T3: Blanched+ ascorbic acid beetroot powder
- T4: Blanched+ vinegar beetroot powder

Table 1. Formulation of *Beetroot instant Khata Meeta Panna mix*

Ingredients	T1 (20%)	T2(30%)	T3(40%)
Beetroot powder(g)	20	30	40
Jaggery (g)	25	25	25
Cumin powder (g)	10	10	10
Black salt (g)	5	5	5
Amchur powder (g)	10	10	10
Mint leaves powder (g)	10	10	10
Ginger powder (g)	10	10	10

Physical properties of beetroot

The physical properties of beetroot include the mass, length, colour, diameter and shape were analysed for the best accepted variation of the developed product.

Sensory evaluation of *Beetroot instant Khata Meeta Panna mix*

Sensory (organoleptic) evaluation was carried out using nine-point hedonic scale. The score card developed for evaluation was based mainly on the appearance, colour, texture/consistency, taste and overall acceptability. Semi trained judges having good health status and interested in sensory evaluation were selected from Department of Food Science and Nutrition, UAS, GKVK, Bengaluru. The panel members were briefed about the product and were instructed individually to evaluate the product.

Nutritional analysis of the best accepted *Beetroot instant Khata Meeta Panna mix*

The developed product's nutritional composition was analysed or estimated using standard method

in the laboratory of Department of Food Science and Nutrition, UAS, GKVK, Bengaluru. The product was analysed for the parameters such as moisture, protein, fat, ash, crude fibre, total Polyphenols using AOAC (2006). Minerals such as calcium, iron, magnesium, manganese, phosphorous, potassium, sodium and zinc will be estimated. Carbohydrates and energy were calculated using the formula method.

Shelf life study of the best accepted *Beetroot instant Khata Meeta Panna mix*

The products were stored up to 30 days at ambient temperature. Each product was stored in Low density poly ethylene (LDPE) and High-density poly ethylene (HDPE). The products were evaluated for their organoleptic acceptability, quality parameters (moisture) at 15 days interval of one-month duration.

Cost estimation of the best accepted *Beetroot instant Khata Meeta Panna mix*

The method adopted for economic analysis was as per Kamaliya (2005). Basic cost of raw ingredients used for product preparation was calculated on the current cost at the time of preparation of the raw ingredients in the wholesale commercial market. For calculations of cost price, 50 per cent of basic cost was added as overhead charges to this and the total cost was 12 considered as the production cost. The selling price was calculated by adding 25 per cent profit to production cost. The experimental product could be sold easily at a premium rate. Therefore, a premium-selling price was calculated with additional marginal premium charges of just 10 per cent more than normal selling price and expressed as percent of extra income gained as compared to the control product.

Statistical analysis

In the present study one-way ANOVA was applied. The data was tabulated and analysed by keeping in view of the objectives and parameters of the study. All the analyses were performed in triplicate and the data was analysed using EXCEL.

RESULTS AND DISCUSSION

Physical properties of beetroot

The physical properties of beetroot include the mass, length, colour, diameter and shape has depicted in Table 1, it found that 158 gm, length

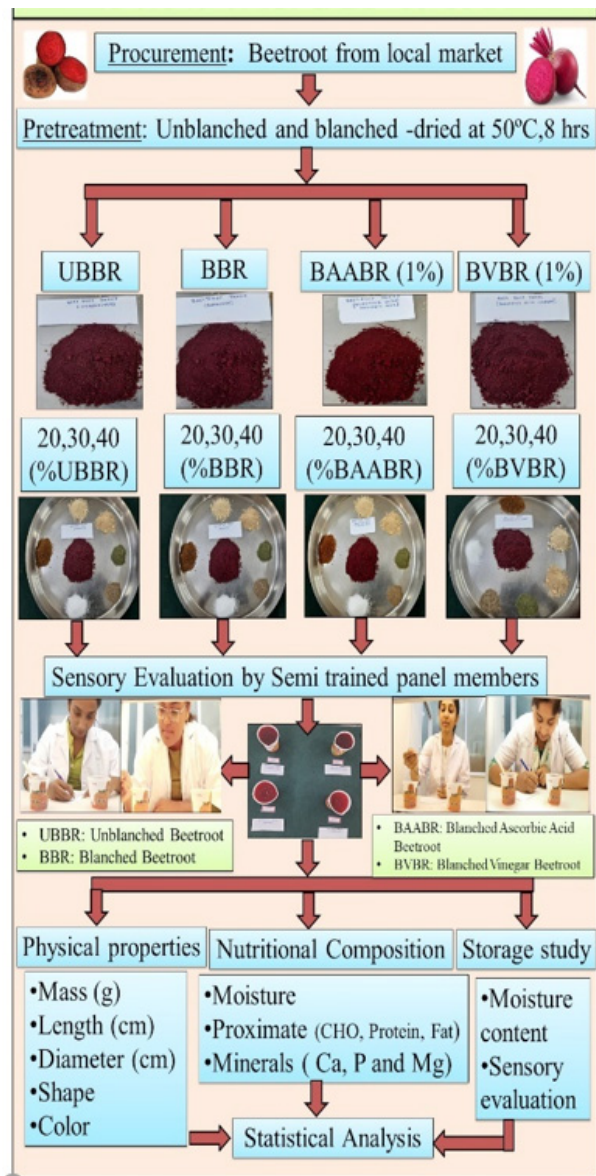


Fig. 1. Study design

14.25 g, dark red colour, 4.74 cm diameter and round shape respectively (Table 2).

Table 2. Physical parameters of Beetroot

Physical parameters	Average value
Mass	158 g
Length	14.25 cm
Colour	Dark red
Diameter	4.74 cm
Shape	Round

Formulation of *Beetroot instant Khata Meeta Panna mix*

Table 3. Formulation of *Beetroot instant Khata Meeta Panna mix*

Ingredients	T1 (20%)	T2(30%)	T3(40%)
Beetroot powder(g)	20	30	40
Jaggery (g)	25	25	25
Cumin powder (g)	10	10	10
Black salt (g)	5	5	5
Amchur powder (g)	10	10	10
Mint leaves powder (g)	10	10	10
Ginger powder (g)	10	10	10

The Table 3 tabulated the formulation of the Beetroot instant Khata Meeta Panna mix with three variations (T1:20%, T2:30% and T3:40%) and keeping other ingredients constant. The study conducted by Dwivedi *et al.* 2017 on dehydrated spinach and beetroot is similar to the obtained results.

Sensory evaluation of *Beetroot instant Khata Meeta Panna mix*

Table 4 depicts the sensory score of the *Beetroot instant Khata Meeta Panna mix*. Organoleptic evaluation to *Beetroot instant Khata Meeta Panna mix* variations and the attributes like appearance, colour, texture, flavour, taste and overacceptability was seen. The score for like appearance, colour, texture, flavour, taste and over acceptability was 8.52, 8.55, 7.56, 8.56, 8.58 respectively. Appearance of the *Beetroot instant Khata Meeta Panna mix* was soothing. It was found from the sensory evaluation that the texture was slightly gritty and could have been finely powdered. *Beetroot instant Khata Meeta Panna mix* was red in colour due to the beetroot powder (Fig. 2).

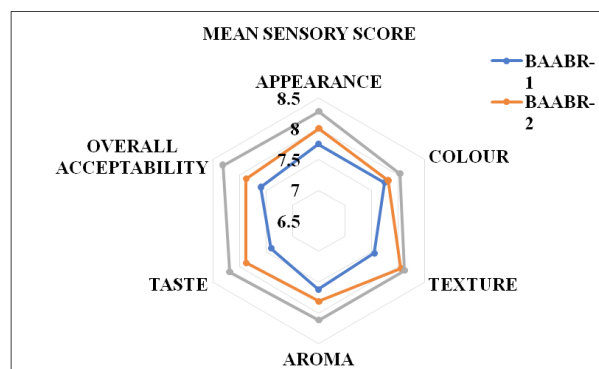


Fig. 2. Mean sensory score Beetroot instant Khata Meeta Panna mix

Nutritive analysis of the best accepted *Beetroot instant Khata Meeta Panna mix*

The nutritional composition of the best accepted *Beetroot instant Khata Meeta Panna mix* Table 5. The moisture 5.92 g, protein 7.17 g, fat 3.90 g, ash 1.99 g, crude fibre 15.42 g, carbohydrates 12.03 g, energy 98.78Kcal. The values indicate that *Beetroot instant Khata Meeta Panna mix* is a very good source of nutrients for the normal growth and development of all the age groups, because *Beetroot instant Khata Meeta Panna mix* was rich in protein, fiber and minerals.

The minerals composition of *Beetroot instant Khata Meeta Panna mix* is presented in Table 4. It was noticed that *Beetroot instant Khata Meeta Panna mix* is the store house of minerals. The total ash content of *Beetroot instant Khata Meeta Panna mix* in the present study was 1.99 g in which the calcium content was 26 mg, magnesium 29 mg and iron was 9.54 mg respectively.

Storage study of the best accepted *Beetroot instant Khata Meeta Panna mix*

Shelf life study was carried out to check the keeping quality of the the best accepted *Beetroot instant Khata*

Meeta Panna mix. Based on the sensory parameters the best accepted products were selected (Table 6). The results showed that upto 15 days the best accepted *Beetroot instant Khata Meeta Panna mix* showed greater scores compared to 30th day which was stored in 2 different packages Low density polypropylene and High-density polypropylene.

Moisture analysis of the best accepted *Beetroot instant Khata Meeta Panna mix*

The results showed that upto 15 days the best accepted *Beetroot instant Khata Meeta Panna mix* showed no increase in moisture content compared to 30th day (Table 7).

Cost estimation of the best accepted *Beetroot instant Khata Meeta Panna mix*

The cost of production is an important consideration for commercialization and successful marketing. The cost of any product depends upon a number of variable factors like cost of raw materials, cost of processing and packaging of the product, etc. Here, the approximate cost of best accepted product (per 100g) is indicated. Overhead charges at 25 per cent of expenditure on manufacturing, which includes

Table 4. Mean sensory score of *Beetroot instant Khata Meeta Panna mix*

Variations	Appearance	Colour	Aroma	Texture	Taste	Overall acceptability
*T ₁ (UBBR)	7.99±0.82	7.60±0.78	7.52±0.66	7.21±0.85	7.69±0.87	7.73±0.86
*T ₂ (BBR)	7.02±0.94	7.35±0.77	7.26±0.78	7.36±1.03	7.46±0.78	8.08±0.73
*T ₃ (BAABR)	8.52±0.94	8.55±0.77	7.56±0.78	8.56±1.03	8.56±0.78	8.58±0.73
*T ₄ (BVBR)	8.17±0.83	7.86±0.69	7.56±0.72	7.52±0.79	7.60±0.83	8.00±0.73

*T₁UBBR: Unblanched Beetroot (20%, 30% and 40%)

*T₃BAABR: Blanched Ascorbic Acid Beetroot (20%,30% and 40%)

*T₂BBR: Blanched Beetroot (20%, 30% and 40%)

*T₄BVBR: Blanched Vinegar Beetroot (20%, 30% and 40%)

Table 5. Nutrient composition of the best accepted *Beetroot instant Khata Meeta Panna mix*

Nutrients	Beetroot instant Khata Meeta Panna mix per 100 g	
	Control (<i>Instant Rasna mix</i>)	Treatment (<i>Beetroot instant Khata Meeta Panna mix</i>)
Moisture (g)	5.27±0.10	5.92±0.06
Fat (g)	5.22±0.09	3.90±0.10
Protein (g)	6.82±0.05	7.13±0.70
Ash (g)	1.55±0.12	1.99±0.10
Crude fibre (g)	10.61±0.43	15.42±0.46
*Carbohydrate (g)	15.59±0.69	12.03±1.01
*Energy (Kcal)	162.67±1.9	98.78±1.74
Calcium (mg)	13.66±0.57	26.66±1.52
Magnesium (mg)	37.00±1.00	29.66±0.57
Iron (mg)	3.29±0.21	9.54±0.09

*Computed values

Table 6. Sensory evaluation of the best accepted *Beetroot instant Khata Meeta Panna mix*

Sensory parameters	Best accepted products(a)	LDPE and HDPE package			
		Storage days			
		Initial	7 th	15 th	30 th
Appearance	Control	9.00	8.90	8.60	8.50
	T3 (30% BAABR)	8.80	8.80	8.80	8.20
Colour	Control	8.05	7.90	7.90	7.10
	T3 (30% BAABR)	7.56	7.40	7.30	7.00
Texture	Control	9.00	8.90	8.60	8.50
	T3 (30% BAABR)	8.80	8.80	8.80	8.20
Taste	Control	8.05	7.90	7.90	7.10
	T3 (30% BAABR)	7.56	7.40	7.30	7.00
OAA	Control	9.00	8.90	8.60	8.50
	T3 (30% BAABR)	8.80	8.80	8.80	8.20

Table 7. Moisture analysis of the best accepted *Beetroot instant Khata Meeta Panna mix*

Storage days	Moisture (g)	
	T3 (LDPE)	T3 (HDPE)
Initial	3.1 g	3.1 g
7 th	3.11 g	3.09 g
15 th	3.17 g	3.09g
30 th	3.19 g	3.12 g

Table 8. Cost economics of the best accepted *Beetroot instant Khata Meeta Panna mix*

Ingredients	Qty (g)	Rate (Rs.)/kg	Cost (Rs)
Beetroot powder(g)	30	40	1.75
Cumin powder (g)	10	100	1.00
Black salt (g)	5	80	0.75
Jaggery (g)	25	55	1.65
Amchur powder (g)	10	260	2.60
Mint leaves powder (g)	10	100	1.00
Ginger powder (g)	10	100	1.00
Total	100		10.00
Overhead charges @25%	2.5		
Profit (10%)	1.0		
Cost of the product	13.5S14.00		

labour cost, depreciation cost on machinery, equipment, building *etc.*, and profit at 10 per cent was included. The production cost of roasted

sunflower seeds burfi is indicated in Table 8. And the results revealed that the total production cost was found to be Rs. 14 per 100g.

CONCLUSION

It could be concluded that the results of this study clearly demonstrated the usefulness of supplementing *panna mix* with beetroot powder as a valuable food addition to enhance nutritional characteristics and technological quality of the beverage. Where, they're a reasonable source of fiber and minerals with good in vitro digestibility and availability, with good stability and extending shelf-life. Along overall sensory quality of the beverage samples, it had satisfactory sensory properties. The most valuable addition with the highest acceptability was the lentil one.

REFERENCES

- EL Wakeel, M.A. 2007. *Ultra Structure and Functional Properties of Some Dry Mixes of Food*. M.Sc. Thesis, Faculty of Agriculture, Ain Shams University, Cairo.
- Ravindran, G. and Matia-Merino, L. 2009. Starch-Fenugreek (*Trigonellafoenum-graecum* L.) Polysaccharide Interactions in Pure and Soup Systems. *Food Hydrocolloids*. 23 : 1047-1053. <http://dx.doi.org/10.1016/j.foodhyd.2008.08.010> 9.