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Value Addition of Beetroot

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Abstract: ***Beetroot (Beta vulgaris) is a root vegetable packed with nutrients and medicinal value. Beets are rich in fibers, folate (Vitamin B9), manganese, potassium, iron, vitamins A and C. It is an immunity booster that gives a wonderful source of iron. It protects against heart diseases. It treats & cures boils & abscesses. It also has unique phytoconstituents having therapeutic importance such as anti-oxidant, antidepressant, antimicrobial, anti-inflammatory, diuretic, and expectorant. But beetroots are not available in every season. So, there is a requirement to preserve this highly nutritious crop for the round-the-year availability of consumers. So, the objective of the present study was to develop some value-added storable products from beetroot and assess their shelf life. In our experiment, we prepared 3 value-added products from beetroot viz. beet jam, beet pickle, and beet powder, followed by their sensory evaluation for appearance, taste, flavour, texture, aroma as well as overall acceptability. Beetroot jam was found to be the best product which was highly accepted by the panellists. Hence, beetroot jam can be explored for the commercial market.***

Keywords: Beta vulgaris, Value added products, Beetroot jam, Beetroot pickle, Beetroot powder

I. INTRODUCTION

Beetroot (*Beta vulgaris* L.) crop belongs to the Chenopodiaceae family having, bright crimson color. It is popular for its medicinal properties and juice value; and is known by many common names like beet, chard, garden beet, and white beet. The bright red color of beetroot is due to the red pigments known as betalains [1]. It contains vitamins A, B_1, B_2, B_6, and C. It is also a good source of calcium, magnesium, copper, phosphorus, sodium, and iron [2]. Beetroot is gaining popularity as a 'super food' due to its health-beneficial value. Beetroot helps in lowering blood pressure and increased blood flow. It is helpful in tumor reduction, decreases the risk of obesity and overall mortality, heart disease, diabetes and promotes healthy hair, increase energy, and overall lower weight [3]. Due to its high fiber content, it prevents constipation and promotes regularity for a healthy digestive tract. Beetroot juice improves oxygenation to the brain, slowing the progression of dementia in older adults [4]. It helps to preserve brain function with nitrates that improve blood flow and beet having the ability to increase the production of Glutathione naturally in the body, that compound helps to prevent colon cancer. Beetroot wine helps the healing of the gastric ulcer. It increases urinary output due to its rich potassium content and cures hypo-glycemia. It is also helpful in the treatment of jaundice, hepatitis, nausea, and vomiting due to biliousness, tuberculosis, piles, cholera, diarrhea, dysentery and lowered state of body resistance after major surgical operations etc. The cellulose content of beet acts as a bulk residue, increases peristalsis, and eases the passage of stool, hence its regular use prevents habitual constipation and lowers blood pressure in hypertensive persons [5]. However, the consumption of beetroot is limited due to its seasonality and perishability, and this leads to the application of various preservation technologies. There are large numbers of red beetroot-based dietary supplements and functional food in the market: juice and juice mixtures (predominantly, with lemon juice), gels, fermented and fractionated juice, dried powder (capsules, tablets, micro-capsulated formulations, crunchy beetroot slices) [6] [7] [8] and beetroot enriched bread [9]. Its powder is used as a natural red food colorant which is used to apply in dry mixes (soups, Indian curry mixes), sweets, jams, jellies, etc. Hence, more research needs to be done on beetroot for the development of novel value-added products. Keeping this in view, we have developed some value-added products of beetroot and have evaluated them for numerous sensory attributes.

II. MATERIALS AND METHODS

A. *Preparation Of Beetroot Powder*

Fresh beetroots were purchased from the local market. Beetroots were washed with tap water 2 times and chopped into small pieces after peeling. Then, beetroots were dried in a hot air oven @ 65^0c for 8 hours till a constant weight of the sample was obtained and the beetroots were completely moisture free and crispy. The beetroots were removed and transferred to a clean mixer jar and ground properly to obtain a fine powder. The whole beetroot powder was divided into two parts. One part powder was filled into the glass jar, labeled, and stored in a cool, dry place. The second part was used for quality and sensory analysis. The whole product did not contain any chemicals, preservatives, artificial colors, or fragrances.

B. Preparation Of Beetroot Jam

Fresh beetroots were purchased from the local market. Beetroots were washed with tap water 2 times and chopped into small pieces after peeling. Initially, 1 Kg of beetroots were taken, however, after trimming and peeling only 750 gm of beetroot was used for jam preparation. The cut pieces were cooked for nearly 45 minutes in a pressure cooker on medium flame till the pieces were soft and smooth. Cinnamon was added to improve the aroma and taste of the jam. Then the boiled cut pieces were cooled and ground in a blender into a fine paste. Then, the ground beetroot was cooked for 15 minutes on medium flame, after which 500 g of sugar was added. Then, it was cooked for till sugar was well mixed with beetroot and the final volume reached 1/3rd of the initial volume.

The endpoint was judged by sheet taste, in which the final jam product was placed on a plate and it was tilted a little. If the product falls off in the form of a sheet or flakes instead of flowing in a continuous stream or syrup, it means that the endpoint has been reached and the product is ready. Otherwise, boiling was continued till the sheet test was positive. After the endpoint has reached citric acid and sodium benzoate were added. Then it was filled hot into sterilized bottles and allowed to cool. They were capped and stored at ambient temperature.

C. Preparation Of Beetroot Pickle

After washing 2 times with tap water, beetroots chopped into small pieces after peeling. Beetroots were boiled for 20-25 minutes followed by rinsing in cold water and straining. Then, salt, vinegar, calcium chloride, water, and citric acid were added to the beetroot as per mentioned above. It was filled into sterilized bottles and allowed to cool. They were capped and stored at ambient temperature.

D. Sensory Analysis

A total of 15 untrained panelists (5 females and 10 males) 25–70 years old participated in a consumer study. Sensory evaluation was conducted inside the college premises including the Department of Agricultural Engineering, Department of Mechanical Engineering, and Department of Civil Engineering. the Food Science Laboratory in Call Hall, Kansas State University. Each panelist evaluated three (N=3) samples of jam, pickle, and powder. Samples were served to panelists monadically. Bread pieces were used as carriers for jam. The panelists were instructed to drink water to cleanse their palate before tasting the samples and at any time during the test as needed. The panelists evaluated all the products on a 9-point hedonic scale [10]. The samples were rated for appearance, taste, aroma, texture, flavour, and overall acceptance. The responses were converted to numbers for data analysis, with dislike extremely=1, dislike strongly=2, dislike moderately =3, dislike slightly = 4, neither like nor dislike =5, like slightly =6, like moderately=7, like strongly=8, and like extremely=9. The following sensory evaluation sheet was given to each panelist.

III. RESULTS AND DISCUSSION

Following the standard methods of preparation of jam, dried powder and pickles of fruits and vegetables, our beetroot products were prepared and packaged in attractive containers.

Fig 1. Different value added products of beetroot (Left:jam, middle:powder & right:pickle)

Appearance of all of our products (jam, pickle and powder) was superior as reviewed by the panelists ranging from 7.33-9.00. Beetroot jam secured the highest score for taste followed by powder. Taste scoring of jam ranged from 7.33 to 9.00 with a mean of 8.35, while scoring of powder ranged between 7.33-8.33 with an average of 7.77. However, beetroot pickle performed poorly in terms taste, which ranged from 4.00 to 7.67 with a mean of 4.87.

TABLE 1. Sensory evaluation for appearance, taste, and flavor of beetroot jam, pickle and powder

PANELISTS	N	APPEARANCE			TASTE			FLAVOR		
		JAM	PICKLE	POWDER	JAM	PICKLE	POWDER	JAM	PICKLE	POWDER
P1	3	8.33	8.33	7.33	8.33	5.33	7.33	8.00	4.00	6.00
P2	3	7.67	8.33	7.33	8.33	6.33	7.33	8.33	5.33	7.00
P3	3	7.67	7.67	7.67	8.33	7.67	7.67	7.00	7.67	7.67
P4	3	8.67	7.33	7.33	8.67	4.33	7.33	8.67	4.33	7.33
P5	3	8.33	8.33	8.33	8.33	5.33	8.33	8.33	5.33	6.33
P6	3	8.33	8.33	8.33	8.33	4.00	8.33	8.33	4.00	6.33
P7	3	9.00	8.33	7.33	9.00	4.00	7.33	7.00	4.33	7.33
P8	3	8.33	8.33	8.33	8.33	4.00	8.33	8.33	4.00	8.33
P9	3	9.00	8.33	7.33	9.00	4.67	7.33	8.00	4.67	7.33
P10	3	7.33	7.33	7.33	7.33	4.67	7.33	7.33	4.67	7.33
P11	3	8.33	8.33	8.33	8.33	4.00	8.33	8.00	4.00	7.33
P12	3	8.00	8.00	8.00	8.00	5.00	8.00	7.33	4.67	7.00
P13	3	8.67	8.67	8.33	8.67	4.00	8.33	8.67	4.00	7.00
P13	3	7.67	7.67	7.67	8.33	4.33	7.67	8.33	4.00	6.00
P14	3	8.00	8.00	8.00	8.00	5.00	8.00	8.00	5.00	7.00
P15	3	8.33	8.33	7.33	8.33	5.33	7.33	8.00	4.00	6.00

Flavor scoring of jam ranged from 7.00 to 8.33 with a mean of 7.98, while the scoring of powder ranged between 6.00-8.33 with an average of 6.96. However, beetroot pickle performed poorly in terms of powder, which ranged from 4.00 to 7.67 with a mean of 4.44. The texture scoring of jam ranged from 8.00 to 9.00 with a mean of 8.40, while scoring of powder ranged between 6.33-9.00 with an average of 7.52. However, beetroot pickle performed poorly in terms of powder, which ranged from 4.00 to 5.33 with a mean of 4.44.

TABLE II. Sensory evaluation for flavor and texture of beetroot jam, pickle and powder

PANELISTS	N	TEXTURE			AROMA			OVERALL ACCEPTABILITY		
		JAM	PICKLE	POWDER	JAM	PICKLE	POWDER	JAM	PICKLE	POWDER
P1	3	9.00	4.00	8.33	9.00	4.00	8.33	8.67	4.33	8.00
P2	3	8.33	4.00	9.00	8.33	4.00	8.00	8.33	4.00	8.33
P3	3	9.00	4.00	8.00	9.00	4.00	8.00	9.00	5.00	8.00
P4	3	8.67	4.33	7.33	8.67	4.33	7.33	8.67	4.33	8.33
P5	3	8.33	5.33	7.00	8.33	4.00	7.00	8.33	4.33	7.00
P6	3	8.33	4.00	6.33	9.00	4.00	8.00	9.00	4.00	8.00
P7	3	8.00	4.33	7.33	8.00	4.33	7.33	8.00	4.33	7.33
P8	3	8.33	4.00	7.33	8.33	4.00	8.67	8.33	4.00	8.67
P9	3	8.00	5.00	7.33	9.00	4.00	7.33	9.00	4.00	8.00
P10	3	8.00	5.33	8.00	9.00	5.33	8.00	9.00	5.33	8.00
P11	3	8.00	4.00	8.00	9.00	4.00	8.00	8.00	5.00	8.00
P12	3	8.33	5.33	8.00	9.00	5.33	8.00	9.00	5.33	8.00
P13	3	8.67	4.00	7.00	9.00	4.00	7.00	8.67	4.00	7.00
P13	3	8.33	4.33	6.00	8.33	4.33	6.00	8.33	5.00	6.00
P14	3	8.00	5.00	7.00	8.00	5.00	7.00	8.00	5.00	7.00
P15	3	9.00	4.00	8.33	9.00	4.00	8.33	8.67	4.33	8.00

The aroma scoring of jam ranged from 8.00 to 9.00 with a mean of 8.69, while scoring of powder ranged between 6.00-8.33 with an average of 7.65. However, beetroot pickle performed poorly in terms of powder, which ranged from 4.00 to 5.33 with a mean of 4.29. Overall acceptability of jam ranged from 8.00 to 9.00 with a mean of 8.56, while scoring of powder ranged between 6.00-8.67 with an average of 7.73. However, beetroot pickle performed poorly in terms of powder, which ranged from 4.00 to 5.33 with a mean of 4.52.

Table III. Mean sensory attributing values of beetroot jam, pickle and powder

	Appearance	Taste	Flavour	Texture	Aroma	Overall acceptability
Beet Jam	8.23	8.35	7.98	8.40	8.69	8.56
Beet Pickle	8.10	4.87	4.63	4.44	4.29	4.52
Beet powder	7.77	7.77	6.96	7.52	7.65	7.73

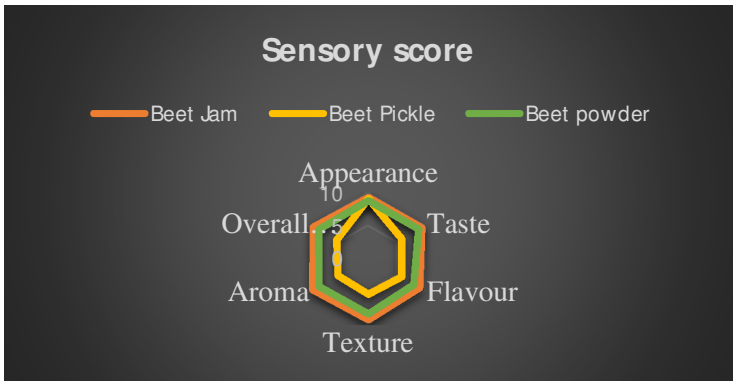

Fig 2. Sensory scores for beetroot jam, pickle and powder

IV. CONCLUSION

Beetroot is a root vegetable packed with nutrients and medicinal value. Beets are rich in fibers, folate, manganese, potassium, iron, vitamins A and C. It is an immunity booster that gives a wonderful source of iron. It also has unique phytoconstituents having therapeutic importance such as anti-oxidant, antidepressant, antimicrobial, anti-inflammatory, diuretic, and expectorant. Due to the non-availability of beetroot round the year, there is need to preserve this highly nutritious crop. In our experiment, 3 value-added products from beetroot viz. beet jam, beet pickle, and beet powder were prepared followed by their sensory evaluation for appearance, taste, flavor, texture, aroma as well as overall acceptability. Beetroot jam was found to be the best product which was highly accepted by the panelists. Hence, beetroot jam can be explored for the commercial market.

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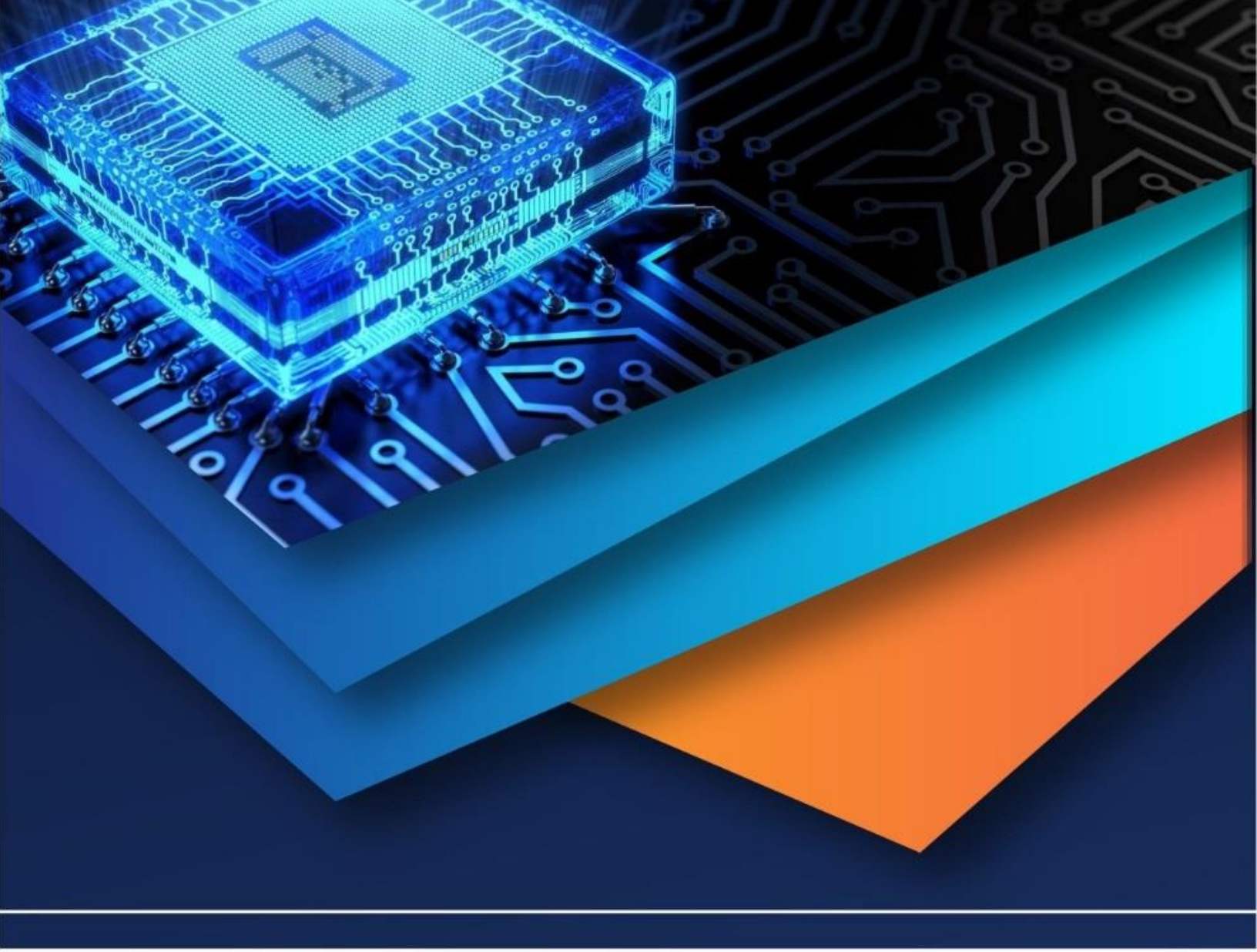

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