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PROCESS DEVELOPMENT & QUALITY EVALUATION OF PINEAPPLE RTS FORTIFIED WITH DRUMSTICK (*Moringa Oleifera*) LEAVES EXTRACT

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Abstract: *The present investigation focuses on standardizing the process for preparation of pineapple RTS beverage by fortification of aqueous Drumstick Leave Extract of 5%, 10% and 15% proportion. Prepared RTS beverage was evaluated for its sensory, physiochemical and nutritional attributes. Overall acceptability was evaluated by using semi-trained panel members on 9 point hedonic rating. It can be concluded that the beverage fortified with Drumstick Leaves Extract at the level of 10% was found to be superior with respect to organoleptic qualities and more nutritious considering the protein, Iron, vitamin A and C content.*

Keywords: *Drumstick Leaves Extract, Fortified pineapple RTS, Moringa Oleifera leaves.*

Introduction

A variety of soft drinks are being presently produced in the country such as sweetened carbonated (aerated) soft drinks, still beverages containing fruit juice/pulp and soda water falling under the category of RTS (ready-to-serve) beverages. Among these the share of fruit juice based beverages are very small compared to synthetic carbonated drinks/soda waters. However, the trend is slowly changing for the obvious advantages of nutritious beverages over the synthetic aerated waters. A type of fruit beverage which contains atleast 10 percent fruit juice and 10 percent total soluble solids besides about 0.3 percent acidity. It is not diluted before serving; hence it is known as Ready-To-Serve (RTS).

Moringa Oleifera is an edible plant. A wide variety of nutritional and medicinal virtues have been attributed to its roots, bark, and leaves, flowers, fruits, and seeds. Phytochemical analyses have shown that its leaves are particularly rich in potassium, calcium, phosphorous, iron, vitamins A and D, essential amino acids, as well as such known antioxidants such as β-carotene, vitamin C, and flavonoids. In fact, *Moringa* is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach.

The leaves of *M. Oleifera* are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper. Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in *M. Oleifera.* Phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar present along with anti-cancerous agents like glucosinolates, isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate. Drumstick Leaves also have a low calorific value and can be used in the diet of the obese.

R.K. Saini *et.al.* (2014) reviewed *Moringa Oleifera*, this plant is native to India, grows in the tropical and subtropical regions of the world. It is commonly known as 'drumstick tree' or 'horseradish tree' belonging to the family of *Moringaceae* is an effective remedy for malnutrition. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. With its high nutritive values, every part of the tree is suitable for either nutritional or

commercial purposes. The leaves are rich in minerals, Vitamins and other essential phytochemicals. Extracts from the leaves are used to treat malnutrition; augment breast milk in lactating mothers. It is used as Potential antioxidant, anticancer, anti-inflammatory, antidiabetic and antimicrobial agent. *M.Oleifera* seed, a natural coagulant is extensively used in water treatment. The scientific effort of this research Provides insights on the use of *Moringa* as cure for diabetes and cancer and fortification of *Moringa* in commercial products.

Sobhy *et.al.* (2015) evaluates the chemical as well as functional properties of the Egyptian *Moringa Oleifera* leaves. Proximate analysis showed that Moringa leaves are rich in: fiber, protein, carbohydrate and energy contents (11.23±0.16, 9.38±0.23, 56.33±0.27 g.100g-1 and 332.68±0.06 KCal, respectively). Moringa is a good source for essential amino acids especially Lysine (69.13±0.13mg.100g-1), essential minerals such as Na (289.34±0.35), K (33.63±0.24), Mg (25.64±0.25) Ca (486.23±0.11), P (105.23±0.32) and Fe (9.45±0.16) mg.100g -1 respectively and vitamins (A=13.48±0.51, B1=0.05±0.28, B2= 0.8±0.25, B3=220±0.42, C= 245.13±0.46 and E= 16.80±0.24 mg.100g respectively). It is appeared using HPLC that methanol 70% is the most suitable solvent for extraction of phenolic compounds from Moringa leaves.

Lakshmipriya et.al. (2015) reviewed Pineapple as *Ananas comosus (L.) Merr.* Family: *Bromeliaceae* is one of the most important commercial fruit crops in the world. It is known as the queen of fruits due to its excellent flavor and taste Pineapple can be used as supplementary nutritional fruit for good personal health. Pineapple fruits are an excellent source of vitamins and minerals. One healthy ripe pineapple fruit can supply about 16.2% of daily requirement for vitamin C. Vitamin C is the body's primary water soluble antioxidant, against free radicals that attack and damage normal cells. A powerful antioxidant, vitamin C supports the formation of collagen in bones, blood vessels, cartilage and muscle, as well as the absorption of iron. Malic acid makes up 13 percent of Pineapple Juice's acidic content. Malic acid is also beneficial for health. It boosts immunity; promotes smooth, firm skin; helps maintain oral health; and reduces the risk of toxic metal poisoning. Pineapple is also a good source of vitamin B1 vitamin B6 copper and dietary fibre.

T.Amaravathi *et.al.* (2014) study was conducted to formulate and optimize a consumer acceptable fresh Moringa leaves (extract) beverage. A constrained three component mixture design consisting of fresh tender Moringa leaves extract, Pineapple Juice and carrot extract was used to optimize the formulation of the beverage based on sensory acceptability (color, taste, flavor, aftertaste and overall acceptability). A constant amount of ginger root distillate was used to improve the flavor of the beverage. The optimum component proportions consisting of 50-52% Moringa extract, 38-40% Pineapple Juice and 10-12% Carrot extract was validated to be adequate and acceptable to consumers. The findings show that fresh Moringa leaves could be processed into acceptable beverage, to extend its beneficial and nutraceutical properties to many consumers.

T.Amaravathi et.al (2014) determine the nutritional composition of fresh Moringa leaf beverage (50% Moringa extract, 38% Pineapple Juice and 12% carrot extract) and assess the keeping quality. Proximate analysis, chemical analysis and shelf stability studies under three different storage conditions of temperature were conducted on the beverage. Fresh Moringa Oleifera beverage recorded 2.9g/100ml of protein, 1.02mg of iron and 159.14mg/100ml of vitamins C. After 8weeks of storage 78% of vitamins C were still retained even under the most severe storage condition (sunlight), the product was still acceptable.

Materials and Methods

Drumstick Leaves (*Moringa Oleifera*) leaves, pineapple, honey & other ingredients were procured from local market. All essential chemicals & instruments were procured from college department.

1) Preparation of Pineapple Juice

Ripe pineapples were selected, the crown and stem portion were removed and the fruit was washed in tap water. The pineapples were peeled with knives, eyes were removed and sliced. The prepared slices were crushed in a mixer using water in proportion (1:0.5). Juice was recovered by pressing the crushed mass in Muslin cloth manually with sanitize hand then the juice was filtered through muslin cloth.

Selecting pineapple fruit (Mature, sound, fresh, ripe and firm)
↓
Removing scaly portions and eyes
↓
Extracting juice with water in proportion (1 : 0.5)
↓
Filtration (muslin cloth)
↓
Pineapple Juice

Figure 1: Flowchart for preparation of Pineapple Juice

2) Preparation of Drumstick Leaves Extract

Fresh leaves were selected and Strip from branches of tree by removing unwanted portion. Stripped leaves were washed in tap water removing adhering dirt. After that it is weigh and crush in mixer grinder with water in proportion (1:2). Pulpy mass of leaves then strained using muslin cloth manually and juice was filtered. Store it in Refrigerator.

Selection of Fresh Leaves Branches of tree (green and appropriate size)
↓
Stripping the fresh leaves and remove unwanted portion other than leaf
↓
Wash leaves in tap water removing adhering Dirt
↓
Extraction with water in proportion (1:2)
↓
Filtering extract (muslin cloth)
↓
Drumstick Leaves Extract

Figure 2: Flowchart for preparation of Drumstick Leaves Extract

3) Recipe standardization of RTS beverage fortified with Drumstick Leaves

Table 1: Formulation of Drumstick Leaves fortified RTS beverage by using different level of aqueous Drumstick Leaves Extract

Sample	Drumstick Leaves Extract (%)	Pineapple Juice (%)	Total (%)
Control	Nil	100	100
T_1	05	95	100
T_2	10	90	100
T_3	15	85	100

4) Preparation of Drumstick Leaves fortified RTS beverage

For three samples, according to formulation mentioned in Table 1, prepared Pineapple Juice was taken. Honey was added to adjust TSS according to FSSAI specification for RTS beverage. The blending of aqueous Drumstick Leave Extract was at different concentration (05%, 10% and 15%) and mixing was carried out. Then the sample made was filled in sterilized PET bottle and ready to serve.

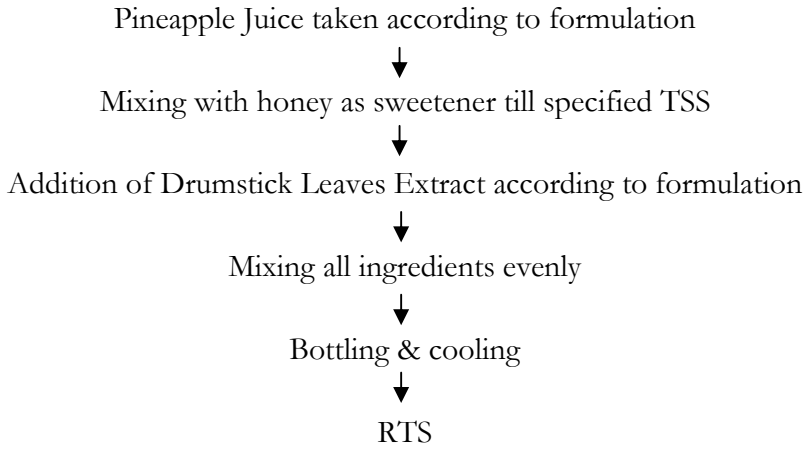

Figure 3: Flowchart for preparation of RTS beverage fortified with Drumstick Leaves.

Results and Discussion

1) Nutritional composition of Drumstick leaves extract

Table 2: Nutritional composition of Drumstick leaves extract

Nutrients	Composition of fresh Drumstick leaves (per 100 g)
Calories (cal)	92.0
Carbohydrate (g)	12.5
Protein (g)	6.7
Fat (g)	1.7
Fibres (g)	0.6
Water (g)	75.0
Magnesium (mg)	42.0
Potassium (mg)	259.0
Calcium (mg)	440.0
Iron (mg)	7.0
Phosphorus (mg)	70.0
Copper (mg)	0.07
Vitamin B_1 (mg)	0.06
Vitamin B_2 (mg)	0.05
Vitamin B_3 (mg)	0.8
Vitamin C (mg)	220
Vitamin E (mg)	448

2) Physical properties of Drumstick leaves

Table 3: Physical parameter of Drumstick leaves

Physical parameters	Result
Length (cm)	17.58
Width (cm)	7.59
Shape	Oval
Colour	Green

3) Nutritional composition of Pineapple Juice

Table 4: Nutritional composition of Pineapple Juice

Nutrients	Composition of fresh Pineapple Juice (per 100 g)
Energy	50 Kcal
Carbohydrates	13.52 g
Protein	0.54 g
Total Fat	0.12 g
Dietary Fiber	1.40 g
Foliates	18 µg
Niacin	0.500 mg
Pyridoxine	0.112 mg
Riboflavin	0.018 mg
Thiamin	0.079 mg
Vitamin A	58 IU
Vitamin C	47.8 mg
Vitamin E	0.02 mg
Vitamin K	0.07 µg
Calcium	13 mg
Copper	0.110 mg
Iron	0.29 mg
Magnesium	12 mg
Manganese	0.927 mg
Phosphorus	8 mg
Selenium	0.1 µg
Zinc	0.12 mg
Sodium	1 mg
Potassium	109 mg

4) Physical properties of Pineapple

Table 5: Physical parameter of fresh pineapple

Physical Parameters	Result
Weight of pineapple (g)	960
Length of fruit without crown (cm)	15
Length of crown (cm)	10.5
Diameter of pineapple (cm)	9.8
Waste index (percent)	32
Edible index (percent)	68
Juice content (percent)	38

5) Sensory Evaluation of Pineapple RTS fortified with Drumstick leaves extract

Table 6: Effect of addition of Drumstick leaves extract on sensory properties of RTS beverage

Treatment	Color	Flavor	Taste	Texture	Appearance	Overall Acceptability
T_1 (05%)	6.45	8.25	8.25	8.45	8.55	8.25
T_2 (10%)	6.55	8.75	8.80	8.95	9.00	8.95
T_3 (15%)	6.42	7.85	7.95	8.20	8.31	7.85
Mean	6.45	8.09	8.31	8.47	8.58	8.28
SE ±	0.021	0.066	0.029	0.048	0.14	0.047
CD at 5% Level	0.067	0.20	0.089	0.15	0.46	0.14

As the Drumstick Leave Extract percent increases the colour changes immediately to green colour which was totally different from current sample, also it give slightly bitter aroma which greatly affects overall acceptability. But taste and flavor which slightly change after addition give increase in acceptability in increasing concentration of extract but it limits till 10% addition. At 15% addition, it gives bitter taste and flavor.

Compared to all samples, overall sensory evaluation show that 10% addition of extract is acceptable. As we consider nutritional and therapeutic properties of Drumstick Leave Extract, it increases with increase in concentration which is also one of the more important criteria for acceptability of RTS beverage. So finally, it reveals that the incorporation of 10% Drumstick Leave Extract was found to be superior to that of other incorporations.

Conclusion

Pineapple RTS beverage as prepared by fortification of aqueous Drumstick Leave Extract in 5%, 10% and 15% proportion. Prepared RTS beverage was evaluated for its sensory, physiochemical and nutritional attributes. It can be concluded that the beverage fortified with Drumstick Leaves Extract at level of 10% was found to be superior with respect to organoleptic and nutritious qualities.

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