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DEVELOPMENT OF BEETROOT ORANGE AND CARROT RTS AND IT'S POTENTIAL OF STORAGE STABILITY

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Abstract : Fruit and Vegetable juices are valuable source of antioxidants because it contains a significant amount of bioactive compounds. The root plants like Beta vulgaris (beetroot) and Daucus carota (carrot) and Zingiber officinale (ginger) possesses wide range of compounds like flavonoids, phenolic acid, amino acid, ascorbic acid, tocopherol and pigments. The antioxidant rich extracts of above roots can be added in fresh juice of Citrus sinensis (orange)for the preparation of refreshing, thirst quenching and energizing. Ready to serve beverage that not only improve the health but also fulfills the nutritional requirements. The formulation was prepared by combination of different proportions of orange juice, beetroot juice, ginger juice and carrot juice. The formulation prepared in the ratio of (10:55:30:5) ml containing of beetroot: orange: carrot ginger: was rated most acceptable by a members on a nine-point hedonic scale and composite scoring test. Proximate composition revealed that sample 2 contains (0.388%) proteins, (13.9%) carbohydrates, (0.06%) fat and (21.454 mg) of vitamin C. RTS Drink satisfactorily for the period up to 90 days at refrigerated temperature. While, the juice of these roots can be used as valuable ingredients for the production of health beverage with all the important properties.

Keywords- Bioactive Compounds, Organoleptic Evaluation, Beetroot, Ascorbic Acid, Proximate Composition.

INTRODUCTION

Fruits and vegetables are important constituents of the diet and provide significant quantities of nutrients, especially vitamins, sugars, minerals and fiber (Sindumathi *et al.*, 2013). Daily consumption of fruits and vegetables reduce the risk of cancer, heart disease, premature aging, stress and fatigue primarily due to the integrated action of oxygen radical scavengers such as β- carotene and ascorbic acid plus calcium and dietary fiber (Sindumathi *et al.*, 2013). Fruit andVegetable based beverages are relished when served chilled, particularly during summers. It has been reported that the organoleptic quality of RTS beverage prepared from juice could be increasedby the addition of spice extracts of ginger, black pepper, mint, cardamom and cumin etc.(Sindumathi *et al.*, 2013).

Ready to serve beverages are sold in a packaged form, ready for consumption. Fruit basedbeverages are relished when served chilled, particularly during summers. These are delicious as well as nutritious containing the goodness of fresh fruit. These spices apart from their appetizing properties also possess medicinal and therapeutic values, which have a profound effect on human health, since they affect many functional processes (Sindumathi *et al.*, 2013).

Beetroot:

The beetroot (*Beta vulgaris*) is the taproot portion of the beet plant, also known as the tablebeet, garden beet, red or golden beet or informally simply as the beet. In recent years increased attention has been focused on utilization of healthy foods. The beetroot (*Beta vulgaris*) being an alkaline food with pH from 7.5 to 8.0 has been acclaimed for its health benefits, in particular for itsdisease fighting antioxidant potential, significant amount of vitamin C and vitamins B1, B2, niacin,B6, B12 whilst the leaves are an excellent source of vitamin A (Singh *et al.*, 2013). The juice of beetroot is also consumed as a natural remedy for sexual weakness and to expel kidney and bladderstones (Sharma *et al.*, 2011). *Beta vulgaris* extracts (root) possess antihypertensive, hypoglycemic, antioxidant (Ninfali *et al.*, 2013), anti- inflammatory, and hepato-protectiveactivities (Singh *et al.*, 2011; Jain *et al.*, 2011; Chakole *et al.*, 2011).

Orange:

Orange (*Citrus sinensis*) is tasty & juicy fruit, belongs to the family *Rutaceae*. *Citrus sinensis* is one of the most important and widely grown fruit crop, with total global production reported to be around 120 million tons (Parle *et al.*, 2012). Orange pulp is an excellent source of vitamin C, providing 64% of the daily requirement of an individual (USDA nutritional Database, 2014). Citrus juices are considered to be a rich source of antioxidants including vitamin C, phenolic compounds (flavonoids) and carotenoidsthat the human body cannot synthesize (Peterson and Dwyer, 2006).Numerous other essential nutrients are present in low amounts. Orange juice contains diverse phytochemicals including carotenoids (beta-carotene, lutein and beta-cryptoxanthin), flavonoids (e.g., naringenin) (Aschoff *et al.*, 2015) and numerous volatile organic compounds producing orange aroma, includingaldehydes, esters, terpenes, alcohols, and ketones (Perez-Cacho *et al.*, 2008). Being a citrus fruit, the orange is acidic: its pH levels are as low as 2.9, and as high as 4.0. (USDA February, 1997)

Carrot:

The carrot (*Daucus carota* sub sp. sativus) is a root vegetable, usually orange in colour, also exist in purple, red, white, and yellow colored varieties. The carrot juice is an appreciable source of carotene and acceptable for its vitamin and mineral contents (Eric, 2008). The most commonly eaten part of a carrot is a taproot, although the green leafs are sometimes eaten as well. Carrots are widely used in many cuisines, especially in the preparationof salads and carrot salads are a traditional in many regional cuisines. The carrot gets itscharacteristic bright orange colour from β-carotene and lesser amounts of α-carotene, γ-carotene, lutein and zeaxanthin (Abdel-Aalel et al., 2013). α and β-carotenes are partly metabolized into vitamin A.

Ginger:

Ginger is widely used as a spice or a folk medicine. Ginger plants are generally 1-3 ft. in height and having different chemical constituents like Amaldehyde, Gingerol, Shogaol, andParadol etc. It has some tremendous beneficial effect on human body to cure various types of diseases (Banerjee *et al.*, 2011). Other members of the family *Zingiberacea*e include turmeric andcardamom. The distantly related dicots in the genus *Asarum* are commonly called wild ginger because of their similar taste. It is widely claimed as a Stomachic, aromatic, carminative, aphrodisiacs, diaphoretic, antiemetic, allergic rhinitis and gastric stimulant and for treating migraine headache (Prasad *et al.*, 2012). It is also used as an antiseptic against intestinal colic (Prasad *et al.*, 2012). Ginger oil is used in mouthwashes and liquors (Evans *et al.*, 1989).

MATERIALS AND METHODS

MATERIALS

The main raw materials used for preparation were beetroot, orange, carrot and ginger. The other ingredients used were sugar and preservatives such as sodium benzoate and citric acid.

METHODS

Procedure for preparation of beetroot orange and carrot RTS drink

Selection of raw material

Good quality of fruits and vegetable were purchased from market and used in the preparationof beetroot-orange RTS.

Washing

The entire ingredients are washed to remove dirt, dust and other contaminant onthe surface.

Peeling

After washing of ingredients all the roots and fruits are peeled out.

Cutting

After peeling the roots are cut in small size required for the juice extraction by grinder.

Juice extraction

Juice extraction was done by using grinder. All juices were extracted separately and store.

Filtration

After juice extraction, the raw juices are filtered through muslin cloth.

Pasteurization

Juices are pasteurized at 85^0C for 30 sec to remove the contaminants from raw Juices.

Mixing

After pasteurization, all juices were mixed in above formulation with addition of sugarsyrup (upto 12^0 Brix). Mixing of juices and preparation of RTS was done.

Filtration

Again, filtered the blends by using muslin cloth.

Filling and crown corking

The RTS was filled in a glass bottles (capacity 200 ml) and crown cork.

Pasteurization

Glass bottles were pasteurized at 85^0 C for 15-20 sec.

Labeling

Labeling was done.

Storage

At refrigeration temperature (at 4 ^{0}C).

RESULTS AND DISCUSSION

Results

Results of chemical analysis

Table no. 1: Result of chemical analysis

Sr. No	Chemical Parameters	Value
1	Energy value (Kcal)	57.20
2	Protein (%)	0.388
3	Carbohydrates (%)	13.9
4	Fat (%)	0.06
5	Vitamin	21.454
6	Ash (%)	2.6
7	Moisture (%)	85.94

The moisture content was in the ranged from 85.94% to 86.01%. The ash content of beetroot-orange RTS was determined and The ash content was found 2.6 %. The fat content of beetroot-orangeRTS was examined and the fat content was 0.06%. The protein content of the beetroot-orangeRTS was 0.288%. The carbohydrates content of beetroot-orange RTS was determined the carbohydrates content was 13.9%.

Table no. 2: Effects on TSS, Acidity and pH during storage

		Storage Period (Days)						
Parameters	Samples	0	15	30	45	60	90	**Mean**
TSS (^{o}Bx)	S1	11.5	12.00	12.20	12.75	13.5	14.00	**10.32**
	S2	12	12	12.5	13.5	14.3	15.00	**13.96**
	S3	11.5	12.10	12.56	13.54	14.43	15.21	**13.22**
	S4	12.5	13.00	13.23	13.87	14.20	15.32	**13.68**
	S5	12	12.5	13.54	14.74	15.00	15.5	**23.88**
	Mean	**11.9**	**12**	**12.80**	**13.68**	**14.29**	**15.06**	
Acidity(%)	S1	0.27	0.28	0.29	0.32	0.37	0.39	**0.32**
	S2	0.31	0.32	0.35	0.38	0.39	0.40	**0.35**
	S3	0.34	0.35	0.37	0.39	0.43	0.47	**0.38**
	S4	0.37	0.38	0.39	0.4	0.42	0.42	**0..39**
	S5	0.39	0.40	0.41	0.43	0.44	0.45	**0.42**
	Mean	**0.33**	**0.35**	**0.36**	**0.37**	**0.48**	**0.43**	
pH	S1	4.4	4.39	4.37	4.23	4.18	4.00	**4.26**
	S2	4.39	4.21	4.1	4.00	3.89	3.75	**3.95**
	S3	4.30	4.27	4.18	4.01	3.87	3.75	**4.6**
	S4	4.1	4.07	4.00	3.76	3.57	3.25	**3.10**
	S5	4.00	3.97	3.76	3.54	3.45	3.27	**3.66**
	Mean	**4.23**	**4.18**	**4.08**	**3.92**	**3.79**	**3.60**	

TSS, pH and acidity values were reported total soluble solids (TSS), Titratable acidity, pH of Beetroot, orange and Carrot RTS drink were analyzed and obtained results are presented in table no.2 increase in TSS and also increase in acidity and

decrease in pH value. The difference in the obtained values till the end of 90 days during the storage period which indicates that all samples were physicochemically stable during 90 days storage at 4°C. The preserved RTS drink was quitestable during storage which confirms that the product remains fresh after 90 days of storage periods.

MICROBIOLOGICAL ANALYSIS

The formed colonies were counted on the plates; total plate count is calculated as follows:

Number of colonies X Dilutions

TPC =

(CFU/ml) Amount of solution taken

Table No.4.4: Microbial Analysis Beetroot, Orange and Carrot RTS

	Storage period (Week)	Yeast and Mold (log cfu/g)	TPC (log cfu/g)
S0	0	00	00
	2	00	00
	4	00	00
	8	2.7	3.0
	12	2.8	3.5
S1	0	00	00
	2	00	00
	4	00	00
	8	2.1	3.0
	12	2.5	3.3
S2	0	00	00
	2	00	00
	4	00	00
	8	2.5	3.0
	12	2.9	3.4
S3	0	00	00
	2	00	00
	4	00	00
	8	3.0	3.5
	12	3.2	5.7
S4	0	00	00
	2	00	00
	4	00	00
	8	2.8	3.4
	12	3.1	3.5

The result shown that the storage period was highly significant on the microbial count of Beetroot, Orangeand Carrot RTS. The microbial status of the of Beetroot, Orange and Carrot showed value of yeast and mould count of S_0 (2.8 1log CFU/g), S_1 (2.5 log CFU/g), S_2 (3.2 log CFU/g), S_3 (3.2 log CFU/g) and S_4 (3.1 log CFU/g) respectively. The storage period on

the microbial count of the of Beetroot, Orange and Carrot revealed that the microbial count gradually increased throughout 90 days of storage period.

The total plate count of bacteria increased after completion of 84 days storage it reached as follows S_0 (3.5 log CFU/g), S_1 (3.3 log CFU/g), S_2 (3.4 log CFU/g), S_3 (3.7 log CFU/g) and S_4 (3.5 log CFU/g). The result clearly indicated the presence of antimicrobial potential due to addition of preservatives.

Shelf life study

The product was analyzed for its shelf life by keeping it at two different temperatures, one at refrigeration temperature and the other at room temperature and its microbial content was analyzed. It was found that the product kept at refrigeration temperature had shelf life up to 90 days because the microbial growth was more in thesample kept at room temperature. The sample kept at room temperature had shelf life up to 20 days.

DISCUSSION

In the present investigations different kinds of blends were developed from beetroot as a basic ingredient and orange, ginger and carrot as a supplement. The developed juices were used to make RTS and evaluated for sensory as well as nutritional characteristics. The obtained results have been discussed as noted below.

RTS is important and rich source of energy and carbohydrates in the diets of population in developing countries. Beet root is one of the roots which are largely consumedin India. It is mainly used in the salad. The consumption of these roots in the common diet of Indian population in general is about 400-600g/day. Thus, roots are taken as basic ingredient to make nutritious and functional RTS drink.

The beetroot (*Beta vulgaris*) being an alkaline food with pH from 4.00 to 5.0 has been claimed for its health benefits, in particular for its disease fighting antioxidant potential, significant amount of vitamin C and vitamins B_1, B_2, niacin, B_6,B_{12} and the leaves are an excellent source of vitamin A (Singh *et al.*, 2013).

Citrus fruit such as orange is blended with the root juices to make it acceptableto the people. Orange is an important source of vitamin C, Calcium and carbohydrates.Orange juice contains diverse phytochemicals including carotenoids (beta-carotene, lutein and beta-cryptoxanthin), flavonoids (e.g., naringenin Aschoff*et al.*, 2015) andnumerous volatile organic compounds producing orange aroma, including aldehydes, esters, terpenes, alcohols, and ketones (Perez-Cacho*et al.*, 2008).

Ginger have different chemical constituents like Amaldehyde, Gingerol, Shogaol, and Paradol etc. It has some tremendous beneficial effect on human body to cure various types of diseases (Banerjee *et al.*, 2011).

The carrot juice is an appreciable source of carotene and acceptable for its vitamin and mineral contents (Eric, 2011).Thus, in the present investigations RTS were developed from beetroot, orange,ginger and carrot. The results showed that ginger and carrot could be supplemented upto the level of 10% showed satisfactory results of RTS without any changes in qualitycharacteristics.

The RTS made from equal ratio of beetroot and orange shows that, the values of various sensory attributes ranged in between 7.7 to 7.8 of sample 1. Similarly, the attribute of colour ranged in between 7.0 to 7.1 and attribute of taste ranged in between 7.0 to 7.1.

The RTS made from 10% of beetroot juice and 40% of orange juice and45% carrot shows that, the values of various sensory attributes ranged in between 8.1 to 8.2 of sample 2.Similarly, the attribute of color ranged in between 7.8 to 7.9 andattribute of taste ranged in between 7.7 to 7.8.

The RTS made from 40% of 10% of beetroot juice and orange juice and45% carrot shows that, the values of various sensory attributes ranged in between 7.0 to 7.1 of sample 3 Similarly, the attribute of colour ranged in between 6.9 to 7.0 and attribute of taste ranged in between 6.9 to 7.0.

CONCLUSION

It was concluded that Sample 2 was found accepted during sensory evaluation then Sample 1, Sample 3, Sample 4 and Sample 5. Beetroot juice, orange juice, carrot juice and ginger juice can be blended in the ratio of (10:30:45:5) to get most effectivetaste. Proximate composition revealed that Sample 2 contains (0.288%) proteins, (13.2%) carbohydrates, (0.06%) fat and (21.454 mg) of vitamin C & was stored satisfactorily for the period of more than 90 days. Shelf life studies shows that quality of product was found good for a period of 45 days. Thus, blend can be recommended for production at commercial level to make nutritious and healthy RTS.

Conflict of Interest:

The authors declare that there is no conflict of interest.

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