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Development and Qualitative Evaluation of Carrot, Sugar Beet and Mint based RTS Stored at Refrigerator Condition

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Studies were conducted for the production of carrot, sugar beet and mint based RTS beverage and its quality evaluation. The quality attributes comprised of acidity, ph, optical density, TSS, ascorbic acid, total plate count and sensory quality parameters on 9-point hedonic scale. Evaluation of quality parameters were done for fresh as well as stored RTS samples at 0, 15, 30, 45, 60, 75 and 90 days of storage under refrigerator storage conditions. RTS beverages carrot, sugar beet and mint samples were packed in glass bottles. The TSS, acidity and optical density of carrot, sugar beet and mint RTS beverages increased with increases in the level of carrot, sugar beet and mint juice ratio. The pH decreased with increased in the level of carrot, beet root and mint juice and pH value of the samples composition 75:20:15, 65:25:10 and 55:30:15 after 90 days of storage were observed as 1.81, 1.86 and 1.80 respectively, at refrigeration condition. The higher score of overall acceptability was 8.03 for the fresh samples however, the overall acceptability of beverage decreased with increase in storage period.

Keywords: Qualitative Evaluation, Carrot, Sugar beet, Mint, RTS, refrigerator.

A variety of soft drinks are presently available in the market but majority of them are synthetic carbonated drinks. But gradually there is a distinct shift towards fruit juice based beverages and now many brands are available in the market. RTS beverages are most popular drink among all the beverages. Fruit based RTS beverages are gaining popularity day-by-day with the introduction of tetra pack. RTS beverages should contain at least 10 per cent juice/pulp and 10 per cent total soluble solids. The acidity of the drinks varies between 0.2 to 0.3 per cent. Fruit and vegetable like mango, pine apple, guava, lemon, grape, apple, litchi, jamun, watermelon, orange, carrot, sugarbeet etc. and their blends are used for the preparation of RTS beverages with or without addition of spices like ginger, cardamom, cumin, mint, black pepper etc. these beverages are far more superior then the synthetic carbonates drinks in the terms of quality. Deka (2000) and Deka and Sethi (2001) reported that two or more fruits juice/ pulp may be blended in various proportions for the preparation of nectar, RTS beverages etc. The blending of juice may also improve aroma, taste and nutrients of the beverages. Moreover, one could think of a new product development through blending in the form of a natural health drink, which may also be served as an appetizer. So far, no more work has been carried out on mixed fruit juice and spiced beverages.

Carrot (*Daucus carota*) belonging to family Apiaceae, is one of the most important cold season root vegetable. Carrot is one of the most

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popular and an important vegetable cultivated and consumed throughout the world. Carrot is a rich source of ²- carotene and contains appreciable amount of thiamine and riboflavin. Carrot juice and its blends are the most popular non-alcoholic beverages (Schieber *et al.,* 2001). Beet (*Beta vulgaris*) is a plant has numerous cultivated varieties, the best known of which is the root vegetable known as the beet root or garden beet. Beets are low in calories (about 45 kcal per 100 g), have zero cholesterol and a minute amount of fat. Nutrition comes from the beets fiber, vitamins, minerals and unique plant derived anti-oxidants. *Mentha arvensis* (commonly known as menthol mint, corn mint or Japanese mint) is widely used in the food, flavourings, pharmaceutical and cosmetic industries. Within the genus *Mentha* there are several commercially grown species, varying in their major chemical content, aroma and end use. Their oils and derived aroma compounds are traded world-wide. In Ayurveda, spearmint is considered a stimulant, carminative and antispasmodic. A sweetened infusion of spearmint herb is used for digestive ailments in infants including colic and for vomiting in pregnancy. It is also used for fever and bronchitis.

Microbial analysis of the stored carrot RTS beverage (90 days) in refrigeration condition indicate the presence of 1- 2 10^{-4}/gram fungi and $1X10^5$ / gram yeast which were considered for safe consumption. Negligible changes were observed in samples stored at refrigeration temperature with preservation. Akn and Evrendilek (2009) conducted studies and found decrease in overall acceptability score of biter gourd RTS beverage during storage period for 180 days.

MATERIALS AND METHODS

The experiment was conducted in Process and Food Engineering laboratory of the department of Agricultural Engineering and Food Technology, Sardar Vallabhbahi Patel University of Agricultural and Technology, Meerut. The studies were carried out to evaluate for the quality of these products after 0, 15, 30, 45, 60, 75 and 90 days of storage. RTS beverage samples were filled in glass bottle of 200 ml capacity. All the samples were stored at refrigerated storage (5^0C).

Raw Material (Carrot, Sugar Beet and Mint): For the extracting of RTS, beverages selected fresh, uniform and fully matured roots of Carrot and, Sugar Beet. Similarly, mint leaves were also procured from the market. During procuring selected fruit free from diseases, insect infestation and other contamination.

Juice Extraction

The juice of Carrot, Sugar Beet and mint was extracted by using

1. Electric Juicer
2. FMC Citrus Juicer

Packing Materials: For the packing of Mint, Carrot, and Sugar Beet, RTS beverages used screw capped glass bottle. Before felling the bottle with RTS its autoclaves at 60^0C for 50 minute. After the prepared beverages RTS was filled in bottle and then stored.

Pasteurization: Beverage in the glass bottles were pasteurized by the method of pasteurization in boiling water bath (85-90 ^{0}C) for 4-5 minute.

Chemicals: The chemicals *i.e.* sugar, citric acid and preservation (KMS) used for the product development was of commercial grade, while for analytical studies laboratory grade or analytical grade chemical were used.

Cooling and Storage: After pasteurization bottles were cooled under the running tap water and then stored under refrigerator use.

Preparation of Carrot, Sugar beet and Mint Ready-To-Serve (RTS) Beverages: RTS beverages should contain at least 10 to 15 per cent fruit juice/ pulp and 10 per cent total soluble solids (^{0}Brix). The acidity of the drinks varies between 0.2 to 0.3 per cent. For the preparation of beverages, fresh Carrot, Sugar Beet and Mint procured from local market Modipuram, Meerut. Mint, Carrot and Sugar Beet were washed with potable water and remove of the dust, dirty particles and microorganisms which fasten with their. After thoroughly washed, peeling was done manually by sharp knife which is sterilized. After peeling stating process the juice extraction. Mint juice was extracted by hand driven screw press machine and for Carrot and Sugar beet juice extraction used electric juicer mixture, after juice extraction of Carrot and Sugar beet it's strained through muslin cloth for remove pulps. The Ready-To-Serve (RTS) beverages is prepared by the extracted juice from Mint, Carrot and Sugar beet, mixing the juice with required quantity of

sugar syrup prepared by sugar, citric acid, preservative (KMS) and mixed also some water for adjustment of soluble solid (TSS) and acidity for RTS beverages as per FPO specification. The prepared beverages filled in the sterilized bottle leaving a head space about 2.5 to 3.0 cm, the bottle cap corked and processed in water for the time of 4 to 6 at 85 ^{0}C for pasteurization and then its cooled in air. After cooling the bottle were labeled and stored at refrigerated condition. Sample containing different ratio of fruit juices like 75:20:5, 65:25:10, 55:30:15 of Mint, Carrot and Sugar Beet were prepared and evaluated by sensory panel. Panel recommended three composition of 75:20:5 Mint, Carrot and Sugar beet (RTS) beverages. The sample of selected composition were prepared and storage for conducting a studies.

RESULTS

The experiments were carried out to develop carrot, sugar beet and mint based RTS beverage and qualitative evaluation of the product. Several physio-chemical parameters *viz.* TSS, acidity, optical density, ascorbic acid, pH, total plate count were evaluated during storage. The RTS beverage samples were stored at refrigerator conditions for 0, 15, 30, 45, 75 and 90 days. Sensory quality attributes (color, taste, flavor, texture and overall acceptability) of carrot, sugar beet and mint beverages were also carried out for the sample during storage. On the basis of the results of the study following conclusions were drawn:

The samples of carrot, sugar beet and mint based of RTS beverages 75:20:5, 65:25:10 and 55:30:15 stored at refrigerator conditions were satisfactory up to 90 days. However, the refrigerator condition was found superior for storage of RTS beverages than other storage condition. The acidity of carrot, sugar beet and mint based RTS beverages increased as increased the ratio of carrot juice or decreased the juice ratio of sugar beet and mint in developed RTS beverages. The acidity of samples increased as the increased storage periods of samples. The pH of all samples carrot, sugar beet and mint based RTS beverages decreased during all over storage period. TSS of carrot, sugar beet and mint based RTS beverages slightly increased with as increased carrot juice ratio as well as increased storage periods. The

Table 1. Changes in TSS, acidity and pH of carrot, sugar beet and mint based RTS beverage sample at refrigeration conditions

Storage	TSS			Acidity (%)			pH		
periods (Days)	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
0	11.50 ±.8164	12.00 ±.8164	12.47 ±.8164	0.117 ±.0004	0.119 ±.0004	0.118 ±.0008	2.70 ±.0081	2.67 ±.0047	2.83 ±.0124
15	11.67 ±.6164	11.33 ±.8164	12.50 ±.6236	0.116 ±.0004	0.121 ±.0008	0.123 ±.0004	2.76 ±.0047	2.85 ±.0124	2.86 ±.0124
30	12.33 ±.6236	12.50 ±.8164	12.67 ±.6236	0.135 ±.0004	0.139 ±.0004	0.136 ±.0004	2.65 ±.0081	2.67 ±.0047	2.68 ±.0047
45	14.33 ±.2357	15.33 ±.2357	15.03 ±.2357	0.135 ±.0004	0.143 ±.0004	0.142 ±.0004	2.57 ±.0047	2.45 ±.0081	2.50 ±.0081
60	16.33 ±.2357	16.67 ±.2357	17.17 ±.7071	0.154 ±.0004	0.160 ±.0008	0.157 ±.0008	2.33 ±.0047	2.25 ±.0047	2.29 ±.0047
75	16.83 ±.2357	17.53 ±.7071	18.17 ±.4714	0.166 ±.0004	0.168 ±.008	0.165 ±.0008	2.03 ±.0081	2.07 ±.0081	2.02 ±.0047
90	19.33 ±.4714	19.53 ±.2357	20.20 ±.2357	0.175 ±.0008	0.176 ±.0004	0.174 ±.0004	1.86 ±.0047	1.81 ±.0047	1.80 ±.0047

$S_1 = C_{75}$: S_{20}: M_5 = (C75: Carrot juice level as 75 %, S20: Sugar beet juice level as 20 %, M5: Mint juice level as 05 % of total juice)

$S_2 = C_{65}$: S_{25}: M_{10} = (C65: Carrot juice level as 65 %, S25: Sugar beet juice level as 25 %, M10: Mint juice level as 10 % of total juice)

$S_3 = C_{55}$: S_{30}: M_{15} = (C55: Carrot juice level as 55 %, S30: Sugar beet juice level as 30 %, M15: Mint juice level as 15% of total juice)

optical density increased was observed as increased in carrot juice ratio in RTS beverages samples during storage periods. The vitamin-C (ascorbic acid) of the RTS sample were decreased during storage period. It might be due to the oxidation or irreversible conversion of L-ascorbic acid in to dehydro-ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottle. The microbial growths were increased during storage periods in samples juice ratio at different conditions.

In general, no defined trend of sensory attributes was observed for the sample which was serving to panel. The highest score for color (8.10) was awarded to sample of carrot, sugar beet an 75:20:5 mint ratio at refrigerator condition. Best score of Flavor (8.20) was found of the juice ratio sample 65:25:10 of carrot: sugar beet: mint juice. The highest score for texture (7.9) was awarded for the sample having carrot, sugar beet and mint juice ratio 75:20:5 at refrigerated condition. Best score of test (8.40) was found to the juice ratio sample 75:20:5 at refrigerator condition. Sensory panel recommended best sample containing 75:20:5 ratios of carrot, sugar beet and mint juice as tested, color, and texture points of view. Decline in sensory score were observed during storage, in general. However, in few cases, increases in score were also observed.

Table 2. Changes in optical density, ascorbic acid and microbial growth of carrot, sugar beet and mint based RTS beverage sample at refrigeration conditions

Storage periods (Days)	Optical Density			Ascorbic Acid (%)			Microbial growth (%)		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
0	0.033 ±.0008	0.041 ±.0009	0.035 ±.0008	5.87 ±.0081	5.67 ±.0047	5.51 ±.0081	ND	ND	ND
15	0.038 ±.0008	0.040 ±.0009	0.039 ±.0008	5.04 ±.0047	4.16 ±.0047	4.07 ±.0047	1.010 ±.0012	1.013 ±.0004	1.015 ±.0008
30	0.048 ±.0004	0.045 ±.2071	0.046 ±.2071	4.11 ±.0047	3.98 ±.0081	3.80 ±.0047	1.018 ±.0008	1.016 ±.0004	1.017 ±.0008
45	0.058 ±.0004	0.062 ±.0004	0.057 ±.0008	4.14 ±.0047	3.37 ±.0047	3.34 ±.0081	1.016 ±.0008	1.023 ±.0004	1.024 ±.0004
60	0.065 ±.0004	0.065 ±.0004	0.068 ±.0004	3.32 ±.0081	2.57 ±.0047	2.53 ±.0081	1.029 ±.0004	1.028 ±.0004	1.027 ±.0004
75	0.071 ±.0008	0.072 ±.0008	0.070 ±.0004	2.54 ±.0081	1.93 ±.0081	1.88 ±.0047	1.033 ±.0004	1.034 ±.0008	1.035 ±.0008
90	0.077 ±.0004	0.075 ±.0004	0.076 ±.0008	1.93 ±.0047	1.68 ±.0081	1.65 ±.0047	1.042 ±.0008	1.045 ±.0004	1.042 ±.0004

$S_1 = C_{75}$: S_{20}: M_5 = (C75: Carrot juice level as 75 %, S20: Sugar beet juice level as 20 %, M5: Mint juice level as 05 % of total juice)

$S_2 = C_{65}$: S_{25}: M_{10} = (C65: Carrot juice level as 65 %, S25: Sugar beet juice level as 25 %, M10: Mint juice level as 10 % of total juice)

$S_3 = C_{55}$: S_{30}: M_{15} = (C55: Carrot juice level as 55 %, S30: Sugar beet juice level as 30 %, M15: Mint juice level as 15% of total juice)

DISSCUSSION

The TSS, acidity and optical density of carrot, sugar beet and mint based RTS increased with increase in the storage periods, same as Yadav *et al.*, 2013 for banana pulp base RTS. The microbial growths were increased during storage periods in samples juice ratio at different conditions same pattern was reported by Kumar, R. S. and Manimegalai, G. (2005). Sensory scores were decline during storage same reported by Markam and Singh, (2002).

CONCLUSION

The pH of all samples carrot, sugar beet and mint based RTS beverages decreased whereas the acidity of samples increased as the increase in storage periods of samples. The microbial growths were increased during storage periods. Decline in sensory score were observed during storage, in general. However, in few cases, increases in score were also observed.

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