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Development and Quality Evaluation of Mixed Fruit (Carrot and Kinnow) based RTS

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Experimental studies were conducted for the production of kinnow and carrot 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 different storage conditions. RTS beverage kinnow and carrot samples were packed in glass bottles. The TSS and acidity of kinnow and carrot RTS beverage increased with increase in the level of kinnow juice ratio at different storage condition and the optical density increased with increase in the level of carrot juice ratio. The pH decreased with increase in the level of carrot juice and pH values of the samples composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.88, 1.95 and 2.00, respectively at refrigerated condition. The total plate count (TPC) of the RTS samples of different kinnow and carrot juice ratio of 80:20, 70:30 and 60:40 were observed as 1.041×10 ^{5}cfu/ml, 1.043×10^{5}cfu/ml and 1.044×10^{5}cfu/ml at refrigerated temperature. The microbial growth increased during storage period irrespective of carrot juice ratio at different storage conditions. The minimum ascorbic acid level of the sample of juice ratio (kinnow: carrot) 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.90, 1.67 and 1.50, respectively at refrigerated condition. The higher score of overall acceptability was 7.92 for the fresh samples and the minimum score awarded for overall acceptability was 6.22 for the RTS sample, kinnow and carrot juice ratio 80:20 at refrigerated condition. However, the overall acceptability of beverage decreased with increase in storage period. It was concluded that refrigerated storage method was found to be superior over other methods of storage of kinnow and carrot based RTS beverage followed by BOD incubator and room temperature conditions.

Keywords: Kinnow, Carrot, RTS, Beverage, Juice, Blending, Physico-chemical and Sensory quality

Ready-to-serve (RTS) beverage is a fruit beverage, which contains at least 10 per cent fruit juice and 10 per cent total soluble solids (TSS) besides, about 0.3 per cent acid. It is not diluted before serving. Production of fruit beverages on a commercial scale was practically unknown till 1930. Since then it has gradually become an important industry. In tropical countries like India, fruit beverages provide delicious cold drink during the hot summer. Due to their nutritive value they are becoming more popular than synthetic drinks, which at present have a very large market in our country. Fruit beverage are easily digestible, highly refreshing, thirst-quenching, appetizing and nutritionally far superior to many synthetic and aerated drinks (Srivastava and Kumar, 2009). Nutritionally, fruit beverages have everything that would be desired in the beverages. These products are marketed under variety of names such as fruit drinks, breakfast drink, ready-to-serve (RTS), nectar, RTD (ready to drink), squash etc. (Lal *et al.,* 2009). In India, citrus is grown in 4, 82,720 ha with a production of 42, 58,514 tons and an average productivity of 8.0 t/ha. The most important commercial citrus cultivars in India are the mandarin (*Citrus reticulata* Blanco) followed by sweet orange (*Citrus sinensis* Osbeck) and acid lime (*Citrus aurantifolia* Swingle*)* sharing 41, 23 and 23 percent, respectively of all citrus fruits produced in the country. India is the sixth largest citrus producing country, which contributes 4.8% of the world's total citrus production. Drinking one glass of 100 per cent orange juice provides several important nutrients including folate, flavonoids, vitamin C and vitamin B_6potassium and magnesium. This "easy peeler" citrus has assumed special economic importance and export demand, because of its high juice content, special flavour, delicious taste and nutritional compositions which are equally beneficial for all age groups. Carrot (*Daucus carota*) belonging to family *Apiaceae*, is one of the most important cool season root vegetable. It is grown extensively in various countries during winter season in tropical regions while during summer season in temperate countries (Kalra *et al.,* 1987). Carrot roots are well known for their nutritional constituents like carotenoids especially β-carotene, which acts as a precursor of vitamin A. β-Carotenoids also act as antioxidants by quenching singlet oxygen and triplet excited states (Chen *et al*., 1998). Carrot can improve eye health, increase menstrual flow

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and regulate blood sugar. Carrot can promote colon health, because it is rich in fiber. Carrot is also helpful in the control of obesity, poisoning of the blood, gum disease, insomnia, inflamed kidney, liver, gallbladder, alzheimer's disease, colitis, ulcer and painful urination. Carrot contains good amount of dietary fiber, which has laxative effect ; aids in digestion and absorption of nutrients, and prevents constipation. In the present study, kinnow was blended with carrot with the objectives to standardize the methodology for the preparation of mixed fruit RTS beverages, and to evaluate it's physico-chemical, microbial and sensory qualities during storage at different temperature conditions.

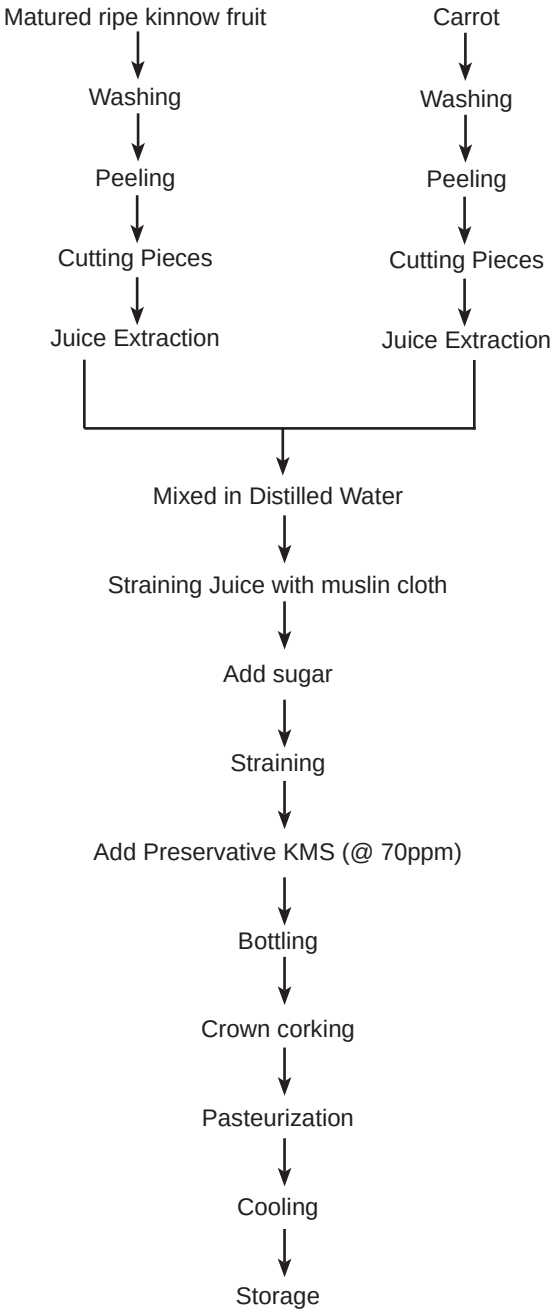
Materials and Methods

Ready-to-serve beverages essentially consist of an amount of 10 to 15 % fruit juice. They are sweetened at least 10° Brix with a maximum acidity of 0.3 %. Fresh kinnow and carrot were procured from local market in Meerut. Kinnow and carrot were washed in potable water to remove the dust, dirty particles and a portion of microbial contaminants. Peeling was done manually. Juice of carrot was extracted by electric juicer mixer and strained through muslin cloth. Kinnow juice was extracted by hand driven screw press. The RTS beverage was prepared from the extracted kinnow and carrot juice, adjusting its soluble solid and acidity as per FPO specification for RTS beverage by mixing the juice with required quantity of sugar syrup prepared from sugar, citric acid, preservative (KMS) and water. The beverage was filled in to bottle leaving a head space of 2.5 to 3.0 cm, crown corked and processed in water for 4 to 6 minute at 85 ^{0}C for pasteurization and then air cooled. Labelled bottles were stored at different temperature condition. Sample containing different fruit juices *viz*. 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80 of kinnow and carrot respectively were prepared and evaluated by sensory panel. Panel recommended three compositions *viz*. 80:20, 70:30, 60:40 of kinnow and carrot, respectively. The bottled samples of selected composition were used in storage studies.

Results and Discussion

Effect on acidity

The acidity of kinnow and carrot RTS beverage showed an increasing trend under all the treatments with increasing period of upto 90 days (fig.1.1). The acidity of samples having kinnow and carrot ratio 80:20, 70:30 and 60:40 were found to be 0.118, 0.116 and 0.115 per cent, respectively in the fresh samples. The increase in the value of acidity was observed either with increase in the ratio of kinnow juice or decrease in the ratio of carrot juice in the RTS. It was further observed that acidity of all the samples increased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The acidity values of the samples with 80:20, 70:30 and 60:40 after 90 days of storage were observed to be 0.174, 0.170, and 0.166 per



Flow chart showing methodology for the preparation of kinnow and carrot ready to serve (RTS) beverage

cent at refrigerated condition. The acidity values of the samples (80:20, 70:30 and 60:40) after 90 days

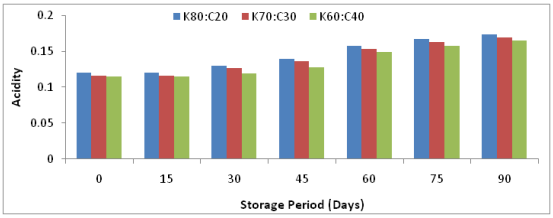


Fig. 1.1. Changes in acidity of the samples of RTS beverage during refrigerated temperature

of storage were 0.178, 0.174 and 0.170 per cent at room temperature and 0.174, 0.172 and 0.170 per

Table 4.1. Changes in TSS (^{0}Brix) of kinnow and carrot based RTS beverage samples at different storage conditions

	TSS								
	Sample								
Storage period (Days)	Room temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	12.33±.4714	11.66 ±.4714	11.00 ±.8164	12.00 ±.6236	11.50 ±.8164	11.00 ±.2357	12.00 ±.4714	11.33 ±.4714	11.00 ±.6236
15	12.33±.4714	11.66 ±.4714	11.00 ±.8164	12.00 ±.6236	11.50 ±.8164	11.00 ±.2357	12.00 ±.4714	11.33 ±.4714	11.00 ±.6236
30	13.90 ±.2357	13.00 ±.2357	12.50 ±.8164	13.00 ±.4082	12.50 ±.2357	12.00 ±.8164	13.83 ±.2357	13.33 ±.2357	13.00 ±.2357
45	14.83 ±.2357	14.16 ±.2357	13.66 ±.4714	13.83 ±.2357	13.50 ±.2357	12.50 ±.4082	15.33 ±.2357	14.33 ±.4714	13.83 ±.2357
60	16.33 ±.2357	15.00 ±.4082	14.33 ±.4714	15.33 ±.4714	14.33 ±.2357	13.16 ±.2357	16.00 ±.4714	15.50 ±.4082	14.66 ±.2357
75	18.33 ±.2357	17.33 ±.2357	16.00 ±.2357	16.83 ±.2357	15.50 ±.4082	15.00 ±.2357	17.66 ±.2357	16.16 ±.2357	15.83 ±.2357
90	20.33±.2357	19.66 ±.2357	18.00 ±.8164	18.33 ±.4714	17.00 ±.7071	16.66 ±.4714	18.50 ±.4082	17.66 ±.4714	16.83 ±.2357

cent at B.O.D. temperature condition. The highest acidity percentage of 0.178 was observed in sample with 80:20 at room temperature after 90 days. In

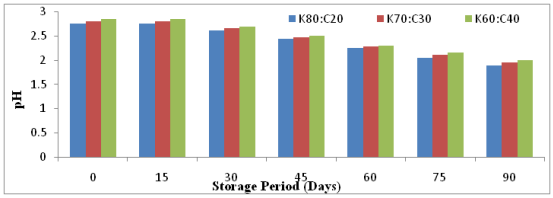


Fig. 1.2. Change in pH of the samples of RTS beverage at refrigerated temperature

general higher value of acidity was found after 90 days irrespective of storage conditions.

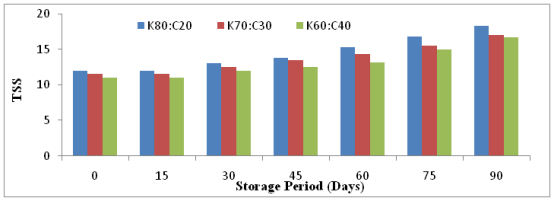


Fig. 1.3. Changes in TSS of the samples of RTS beverage during refrigerated temperature

Effect on pH

The pH of the samples of different kinnow and carrot juice ratio of 80:20, 70:30 and 60:40 were

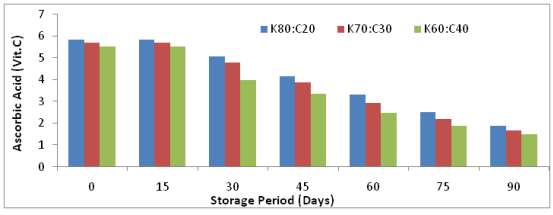


Fig. 1.4. Changes in ascorbic acid of the samples of RTS beverage during refrigerated temperature

measured as 2.90, 2.92 and 0.2.95, respectively in the fresh samples. The decrease in the value of pH was observed either with increase in the ratio of kinnow juice or decrease in the ratio of carrot juice in RTS (Fig.1.2). During storage, it was observed that pH of all the samples were decreased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The pH values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.88, 1.95 and 2.00 at refrigerated condition. The pH values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.85, 1.95 and 2.00 at room temperature and 1.88, 1.90 and 1.95 at B.O.D. temperature condition, respectively. The

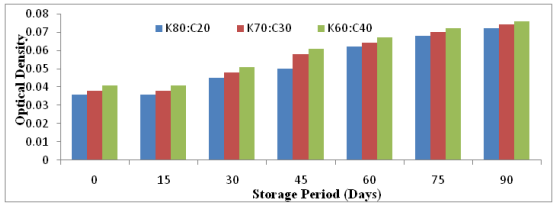


Fig. 1.5. Changes in O.D. of the samples of RTS beverage during refrigerated temperature

lowest pH (1.85) of the sample with 80:20 sample was observed in room temperature after 90 days.

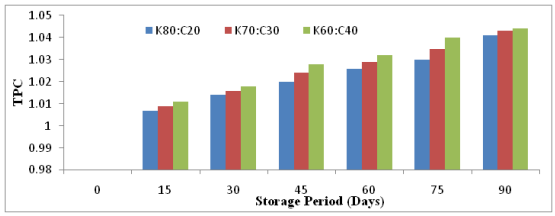


Fig. 1.6. Changes in TPC (×10 ^{5}cfu/ml) of the samples of RTS beverage during refrigerated temperature

However, in general lower value of pH was found after 90 days in each of the storage conditions.

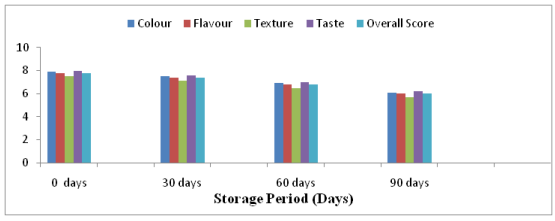


Fig. 1.7. Changes in sensory qualities of the sample 80:20 during room temperature

Effect on TSS (^{0}Brix)

The TSS content in kinnow and carrot RTS beverage showed an increasing trend under all the treatments with increasing periods of up to 90 days (Fig.1.3). The TSS of the samples having kinnow and carrot juice ratio 80:20, 70:30 and 60:40 were measured as 12.33, 11.66 and 11.00 ^{0}Brix, respectively in the fresh samples. During storage, it

Table 4.2. Changes in acidity of kinnow and carrot based RTS beverage samples at different storage conditions

Storage period (Days)	Acidity (%)								
	Sample								
	Room Temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	0.118 ±.0004	0.116 ±.0004	0.115 ±.0004	0.121 ±.0004	0.117 ±.0008	0.115 ± .0004	0.118 ±.0008	0.116 ±.0004	.0114 ±.0008
15	0.118 ±.0004	0.116 ±.0004	0.115 ±.0004	0.121 ±.0004	0.117 ±.0008	0.115 ± .0004	0.118 ±.0008	0.116 ±.0004	.0114 ±.0008
30	0.127 ±.0004	0.122 ±.0008	0.120 ±.0004	0.130 ±.0004	0.127 ±.0004	0.120 ±.0004	0.128 ±.0004	0.126 ±.0004	0.124 ±.0004
45	0.137 ±.0008	0.130 ±.0004	0.128 ±.0004	0.140 ±.0004	0.137 ±.0004	0.128 ±.0004	0.138 ±.0004	0.136 ±.0004	0.134 ±.0008
60	0.164 ±.0008	0.156 ±.0008	0.151 ±.0008	0.158 ±.0008	0.154 ±.0004	0.150 ±.0008	0.160 ±.0004	0.158 ±.0008	0.154 ±.0004
75	0.168 ±.0004	0.164 ±.0008	0.160 ±.0008	0.168 ±.0004	0.164 ±.0004	0.158 ±.0004	0.168 ±.0004	0.166 ±.0008	0.164 ±.0004
90	0.178 ±.0004	0.174 ±.0004	0.170 ±.0004	0.174 ±.0004	0.170 ±.0008	0.166 ±.0004	0.174 ±.0004	0.172 ±.0004	0.170 ±.0004

was observed that TSS of all the samples increased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The TSS values of the sample 80:30, 70:30 and 60:40 after 90 days of storage were observed as18.33, 17.0, and 16.66 ^{0}Brix at refrigeration condition. The TSS values of the sample 80:30, 70:30 and 60:40 after 90 days

Table 4.3. Change in pH of kinnow and carrot based RTS beverage samples at different storage conditions

Storage period (Days)	pH								
	Sample								
	Room Temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	2.90 ±.0377	2.92 ±.0047	2.95 ±.0047	2.75 ±.0047	2.80 ±.0081	2.84 ±.0047	2.80 ±.0047	2.86 ±.0124	2.90 ±.0047
15	2.90 ±.0377	2.92 ±.0047	2.95 ±.0047	2.75 ±.0047	2.80 ±.0081	2.84 ±.0047	2.80 ±.0047	2.86 ±.0124	2.90 ±.0047
30	2.69 ±.0047	2.72 ±.0081	2.78 ±.0081	2.60 ±.0047	2.65 ±.0081	2.68 ±.0047	2.64 ±.0047	2.67 ±.0047	2.70 ±.0081
45	2.54 ±.0081	2.57 ±.0047	2.60 ±.0047	2.44 ±.0047	2.47 ±.0081	2.47 ±.0047	2.50 ±.0047	2.54 ±.0081	2.57 ±.0047
60	2.34 ±.0047	2.38 ±.0081	2.40 ±.0047	2.24 ±.0047	2.27 ±.0081	2.27 ±.0047	2.30 ±.0047	2.34 ±.0081	2.38 ±.0047
75	2.10 ±.0081	2.24 ±.0047	2.34 ±.0047	2.04 ±.0081	2.10 ±.0047	2.15 ±.0081	2.08 ±.0047	2.14 ±.0081	2.20 ±.0047
90	1.85 ±.0047	1.95 ±.0047	2.00 ±.0047	1.88 ±.0047	1.95 ±.0081	2.00 ±.0047	1.88 ±.0047	1.90 ±.0047	1.95 ±.0081

of storage were observed as 20.33, 19.66 and 18.0 ^{0}Brix at room temperature and 18.5, 17.66 and 16.83 ^{0}Brix at B.O.D. temperature condition respectively. This increase in the TSS may be due to the fact that

Table 4.4. Changes in optical density of kinnow and carrot based RTS beverage samples at different storage conditions

Storage period (Days)	Optical Density								
	Sample								
	Room Temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	0.035 ±.0009	0.038 ±.0004	0.041 ±.0009	0.036 ±.0008	0.038 ±.0004	0.041 ±.0004	0.033 ±.0004	0.037 ±.0008	0.040 ±.0009
15	0.035 ±.0009	0.038 ±.0004	0.041 ±.0009	0.036 ±.0008	0.038 ±.0004	0.041 ±.0004	0.033 ±.0004	0.037 ±.0008	0.040 ±.0009
30	0.044 ±.2071	0.048 ±.0004	0.052 ±.0004	0.045 ±.0012	0.048 ±.0004	0.051 ±.0004	0.050 ±.0008	0.054 ±.0004	0.058 ±.0008
45	0.055 ±.0008	0.058 ±.0004	0.062 ±.0004	0.050 ±.0004	0.058 ±.0004	0.061 ±.0008	0.055 ±.0004	0.057 ±.0008	0.060 ±.0004
60	0.062 ±.0004	0.065 ±.0004	0.067 ±.0004	0.062 ±.0008	0.064 ±.0008	0.067 ±.0004	0.058 ±.0004	0.062 ±.0004	0.066 ±.0008
75	0.064 ±.0004	0.069 ±.0004	0.072 ±.0012	0.068 ±.0004	0.070 ±.0008	0.072 ±.0004	0.067 ±.0004	0.069 ±.0004	0.072 ±.0004
90	0.072 ±.0004	0.075 ±.0008	0.077 ±.0004	0.072 ±.0008	0.074 ±.0004	0.076 ±.0004	0.072 ±.0008	0.074 ±.0004	0.079 ±.0004

the kinnow juice contains more TSS in comparison to juice obtained from carrot. Baramanray *et al.,* (1995) and Pandey, (2004) observed the increase in TSS value of RTS beverages during storage were

Table 4.5. Changes in ascorbic acid of kinnow and carrot based RTS beverage samples at different storage conditions

Storage period (Days)	Ascorbic Acid(mg/100ml)								
	Sample								
	Room Temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	5.82 ±.0081	5.71 ±.0047	5.51 ±.0081	5.83 ±.0081	5.71 ±.0047	5.53 ±.0047	5.82 ±.0124	5.70 ±.0047	5.52 ±.0081
15	5.82 ±.0081	5.71 ±.0047	5.51 ±.0081	5.83 ±.0081	5.71 ±.0047	5.53 ±.0047	5.82 ±.0124	5.70 ±.0047	5.52 ±.0081
30	5.05 ±.0081	4.50 ±.0047	4.05 ±.0081	5.08 ±.0047	4.80 ±.0081	4.00 ±.0047	5.10 ±.0081	4.50 ±.0047	4.03 ±.0047
45	4.15 ±.0047	3.80 ±.0081	3.32 ±.0081	4.16 ±.0047	3.90 ±.0047	3.35 ±.0081	4.13 ±.0047	3.90 ±.0081	3.32 ±.0047
60	3.38 ±.0047	3.00 ±.0047	2.48 ±.0047	3.31 ±.0081	2.95 ±.0081	2.49 ±.0081	3.33 ±.0047	2.83 ±.0047	2.46 ±.0047
75	2.53 ±.0047	2.20 ±.0081	1.93 ±.0047	2.52 ±.0081	2.20 ±.0047	1.90 ±.0047	2.50 ±.0047	2.25 ±.0081	2.00 ±.0047
90	1.92 ±.0081	1.66 ±.0047	1.60 ±.0081	1.90 ±.0047	1.67 ±.0081	1.50 ±.0047	1.94 ±.0081	1.68 ±.0081	1.63 ±.0047

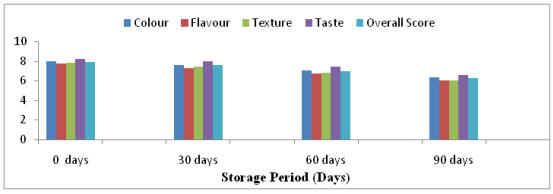


Fig. 1.8. Changes in sensory qualities of the sample 80:20 during refrigerated temperature

probably due to conversion of polysaccharides in to soluble sugars.

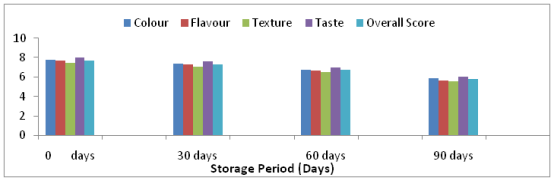


Fig. 1.9. Changes in sensory qualities of the sample 80:20 during B.O.D. temperature

Effect on ascorbic acid

The ascorbic acid of the samples of different kinnow and carrot juice ratio of 80:20, 70:30 and 60:40 were measured as 5.82, 5.71 and 5.51, respectively in the fresh samples. During storage, it was observed that ascorbic acids of all the samples were decreased at 0, 15, 30, 45, 60, 75 and 90 days of storage (Fig.1.4). The ascorbic acid values of the samples of the ratio (kinnow and carrot) 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.90, 1.67 and 1.50 at refrigerated condition. The ascorbic acid values of the samples 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.92, 1.66 and 1.60 at room temperature and the ascorbic acid values of the samples 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.94, 1.68 and 1.63 at B.O.D. condition. The lowest ascorbic acid level of 1.50 was observed in refrigerator temperature storage after 90 days in 60:40 sample. However, in general lower values of ascorbic acid for different samples were found to be lowest after 90 days of storage.

Effect on optical density

The optical density of the samples of different kinnow and carrot juice ratio 80:20, 70:30 and 60:40 were measured as 0.035, 0.038 and 0.041 respectively, in the fresh samples. During storage, it was observed that optical density of all the samples increased at 0, 15, 30, 45, 60, 75 and 90 days of storage (Fig.1.5). The optical density values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 0.072, 0.074 and 0.076 at refrigerated condition. The optical density values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 0.072, 0.075 and 0.077 at room temperature and 0.072, 0.074 and 0.079 at B.O.D. condition respectively. It was observed from the data that with increase in the level of carrot juice in RTS, the optical density of the products increased. The highest optical density of 0.079 was observed at B.O.D. storage after 90 days in samples with 60:40.

Effect on microbial growth

The microbial growth (TPC values) of the samples of different kinnow and carrot based RTS beverage were observed as 1.008×10^{5}cfu/ml, 1.010×10^{5}cfu/ml and 1.011×10^{5}cfu/ml for 80:20, 70:30 and 60:40 samples at room temperature after 15 days. The microbial growth of the samples of different kinnow and carrot RTS beverage were observed as 1.007×10^{5}cfu/ml, 1.009×10^{5}cfu/ml and 1.011×10^{5}cfu/ml of 80:20, 70:30 and 60:40 sample at refrigerated temperature condition after 15 days and microbial growth value of kinnow and carrot RTS beverage were observed as 1.010×10^{5}cfu/ml, 1.012×10^{5}cfu/ml and 1.014×10^{5}cfu/ml for 80:20, 70:30 and 60:40 sample at B.O.D. condition after of 15 days. The microbial growth value after 90 days of storage were observed as 1.038×10^{5}cfu/ml, 1.039×10^{5}cfu/ml and 1.040×10^{5}cfu/ml for the sample stored at room temperature. The study also revealed that the microbial growth increased with increase of storage period irrespective of storage conditions. The highest microbial growth was observed (1.048×10^{5}cfu/ml) in case of sample having kinnow and carrot juice ratio 60:40 at B.O.D. condition after 90 days of storage.

Effect on sensory quality

Sensory qualities were evaluated for all fresh as well as stored samples after 0, 30, 60 and 90 days. The samples were served to panellists. Colour, flavours, texture and taste were selected as sensory attributes on 9-point Hedonic scale.

Table 4.6. Changes in microbial growth ($\times10^{5}$cfu/ml) of kinnow and carrot based RTS beverage samples at different storage conditions

Storage period (Days)	Microbial Growth								
	Sample								
	Room Temperature			Refrigerator			B.O.D.		
	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$	$K_{80}:C_{20}$	$K_{70}:C_{30}$	$K_{60}:C_{40}$
0	ND	ND	ND	ND	ND	ND	ND	ND	ND
15	1.008 ±.0004	1.010 ±.0004	1.011 ±.0004	1.007 ±.0004	1.009 ±.0008	1.011 ±.0008	1.010 ±.0012	1.012 ±.0004	1.014 ±.0004
30	1.014 ±.0008	1.016 ±.0004	1.018 ±.0004	1.014 ±.0004	1.016 ±.0004	1.018 ±.0008	1.016 ±.0004	1.018 ±.0008	1.020 ±.0004
45	1.018 ±.0008	1.020 ±.0004	1.022 ±.0004	1.020 ±.0004	1.024 ±.0004	1.028 ±.0008	1.023 ±.0004	1.025 ±.0008	1.027 ±.0004
60	1.025 ±.0004	1.026 ±.0008	1.028 ±.0004	1.026 ±.0004	1.029 ±.0008	1.032 ±.0008	1.030 ±.0004	1.032 ±.0004	1.036 ±.0008
75	1.028 ±.0004	1.030 ±.0008	1.031 ±.0008	1.030 ±.0008	1.035 ±.0004	1.040 ±.0004	1.036 ±.0004	1.040 ±.0004	1.042 ±.0004
90	1.038 ±.0004	1.039 ±.0004	1.040 ±.0004	1.041 ±.0004	1.043 ±.0008	1.044 ±.0004	1.043 ±.0008	1.045 ±.0004	1.048 ±.0008

In general no definite trends of sensory score for individual attributes were observed for fresh samples. The highest score awarded for colour was 8.0 to the sample having fruit juice composition of 80:20

Table 4.7. Effects of composition of fruit juices, temperature and storage period on sensory qualities of fresh mixed fruit RTS beverage

Storage Period	No. of samples (Levels)\	Sensory Qualities				Overall score
		Colour	Flavour	Texture	Taste	
Room Temperature (35^{0}C)	K_{80}:C_{20}	7.9	7.8	7.5	8.0	7.80±0.187
	K_{70}:C_{30}	7.8	8.0	7.6	8.1	7.87 ±0.192
	K_{60}: C_{40}	7.6	7.8	7.6	7.7	7.67 ±0.082
Refrigerator (5^{0}C)	K_{80}:C_{20}	8.0	7.7	7.8	8.2	7.92 ±0.192
	K_{70}:C_{30}	7.9	7.8	7.7	8.0	7.85 ±0.111
	K_{60}: C_{40}	7.7	7.6	7.7	7.9	7.72 ±0.108
B.O.D. (25^{0}C)	K_{80}:C_{20}	7.8	7.7	7.5	8.0	7.75 ±0.180
	K_{70}:C_{30}	7.7	7.9	7.6	7.9	7.77 ±0.129
	K_{60}: C_{40}	7.5	7.7	7.5	7.6	7.57 ±0.082

at refrigerated temperature. Whereas, the lowest score (5.6) for the sample 60:40 at B.O.D. Except one sample (60:40), all other samples were rated

Table 4.8. Effects of composition of fruit juices, temperature and storage period on sensory qualities of mixed fruit RTS beverage after 15 days

Storage Period	No. of samples (Levels)	Sensory Qualities				Overall score
		Colour	Flavour	Texture	Taste	
Room Temperature (35^{0}C)	K_{80}:C_{20}	7.5	7.4	7.1	7.6	7.40 ±0.187
	K_{70}:C_{30}	7.4	7.6	7.3	7.7	7.50 ±0.158
	K_{60}: C_{40}	7.2	7.4	7.2	7.3	7.27 ±0.082
Refrigerator (5^{0}C)	K_{80}:C_{20}	7.6	7.3	7.4	8.0	7.57 ±0.268
	K_{70}:C_{30}	7.5	7.4	7.3	7.8	7.50 ±0.187
	K_{60}: C_{40}	7.4	7.3	7.2	7.5	7.35 ±0.111
B.O.D. (25^{0}C)	K_{80}:C_{20}	7.4	7.3	7.1	7.6	7.35 ±0.180
	K_{70}:C_{30}	7.3	7.4	7.2	7.4	7.32 ±0.082
	K_{60}: C_{40}	7.1	7.3	7.1	7.2	7.17 ±0.082

between “Like extremely” and “Like slightly”. The best score for flavour was 8.0 to the sample having fruit juice composition of 70:30 at room temperature and

Table 4.9. Effects of composition of fruit juices, temperature and storage period on sensory qualities of mixed fruit RTS beverage after 60 days

Storage Period	No. of samples (Levels)	Sensory Qualities				Overall score
		Colour	Flavour	Texture	Taste	
Room Temperature (35^{0}C)	K_{80}:C_{20}	6.9	6.8	6.5	7.0	6.80 ±0.187
	K_{70}:C_{30}	6.8	7.0	6.7	7.1	6.90 ±0.158
	K_{60}: C_{40}	6.6	6.8	6.6	6.7	6.67 ±0.082
Refrigerator (5^{0}C)	K_{80}:C_{20}	7.0	6.7	6.8	7.4	6.97 ±0.268
	K_{70}:C_{30}	6.9	6.8	6.7	7.2	6.90 ±0.187
	K_{60}: C_{40}	6.7	6.7	6.8	6.9	6.77 ± 0.082
B.O.D. (25^{0}C)	K_{80}:C_{20}	6.8	6.7	6.5	7.0	6.75 ±0.180
	K_{70}:C_{30}	6.7	6.8	6.6	6.9	6.75 ±0.111
	K_{60}: C_{40}	6.5	6.7	6.5	6.6	6.75 ±0.082

Table 5.0. Effects of composition of fruit juices, temperature and storage period on sensory qualities of mixed fruit RTS beverage after 90 days

Storage Period	No. of samples (Levels)	Sensory Qualities				Overall score
		Colour	Flavour	Texture	Taste	
Room Temperature (35^{0}C)	K_{80}:C_{20}	6.1	6.0	5.7	6.2	6.00 ±0.187
	K_{70}:C_{30}	6.0	6.1	5.8	6.3	6.05 ±0.180
	K_{60}: C_{40}	5.9	5.9	5.8	6.0	5.90 ±0.707
Refrigerator (5^{0}C)	K_{80}:C_{20}	6.3	6.0	6.0	6.6	6.22 ±0.248
	K_{70}:C_{30}	6.2	6.1	5.9	6.4	6.15 ±0.180
	K_{60}: C_{40}	6.1	6.0	6.0	6.2	6.07 ±0.180
B.O.D. (25^{0}C)	K_{80}:C_{20}	5.9	5.7	5.6	6.1	5.82 ±0.192
	K_{70}:C_{30}	5.8	5.8	5.7	6.0	5.82 ±0.192
	K_{60}: C_{40}	5.6	5.7	5.6	5.7	5.65 ±0.050

the lowest score 5.7 the sample for 80:20 at B.O.D. The highest score awarded for texture was 7.8 for the sample having juice ratio 80:20 at refrigerator of and the lowest score of 5.6 for the sample 80:20 at B.O.D. All other samples were rated between “Like very much” and “like slightly”. The highest score awarded for taste was 8.2 for the sample 80:20 at refrigerated condition. Whereas, the lowest score was 5.7 for the sample with 60:40 at B.O.D. Overall sensory scores after 90 days of storage were the lowest (5.6) “Like slightly and the highest (7.9) “Like very much. Sensory evaluation could not be conducted after 90 days of storage due to visible microbial growth in all the stored samples. Sharma *et al*., (2008) revealed that the highest score was 7.55 for 80:20 guava : papaya juice.

Conclusion

The sample of kinnow and carrot based RTS beverage 80:20, 70:30 and 60:40 stored at room temperature, B.O.D incubator, and refrigerated storage were acceptable up to 90 days. However, the RTS samples stored at refrigerated condition was found to be superior over other storage condition. The acidity of kinnow and carrot based RTS beverage increased with increase in the ratio of kinnow juice. Acidity of samples increased with increase in the storage period. TSS of kinnow and carrot based RTS beverage increased slightly with increase in kinnow juice, ratio as well as with increase in the storage period. The increase in optical density was observed with increase in carrot juice ratio in RTS samples during storage period. The vitamin-C (ascorbic acid) content of the RTS samples decreased during storage period. The microbial growth increased during storage period irrespective of kinnow juice ratio at different storage conditions. In general, no definite trend of sensory attributes was observed for the samples. The highest score for colour (8.0) was awarded to samples of kinnow and carrot juice ratio 80:20 at refrigerated condition. The best score of flavour (8.0) was found with 70:30 sample at room temperature. The highest score for texture (7.8) was awarded for the sample having kinnow and carrot juice ratio of 80:20 at refrigerated condition. The best score of

taste (8.2) was found with the juice ratio of 80:20 at refrigerated condition. Sensory panel recommended the best sample containing 80:20 ratio for kinnow and carrot juice with respect to taste, colour and texture.

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