

Qualitative evaluation of mixed fruit based ready to serve (RTS) beverage

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■ **ABSTRACT** : The ready to serve (RTS) beverage was prepared by blending the orange and carrot juice in the ratios of $O_{40}:C_{60}$, $O_{50}:C_{50}$ and $O_{60}:C_{40}$ and stored at room temperature and refrigeration up to 45 days. The quality parameters pH, TSS, acidity and overall acceptability (OAA) were also evaluated at an interval of 15 days. The TSS and acidity of RTS beverage increased and pH was decreased with increase in the level of carrot juice ratio under different storage conditions. The higher score of overall acceptability was 8.05 for fresh sample of $O_{60}:C_{40}$ and the minimum was 7.90 for ratio of $O_{50}:C_{50}$ sample at room temperature. However, the overall acceptability of RTS decreased with increase in storage period. Results of study concluded that RTS beverage was found superior under refrigeration condition as compared to room temperature.

■ **KEY WORDS** : TSS, Acidity, pH, Beverage, Refrigeration temperature, Quality, Room temperature

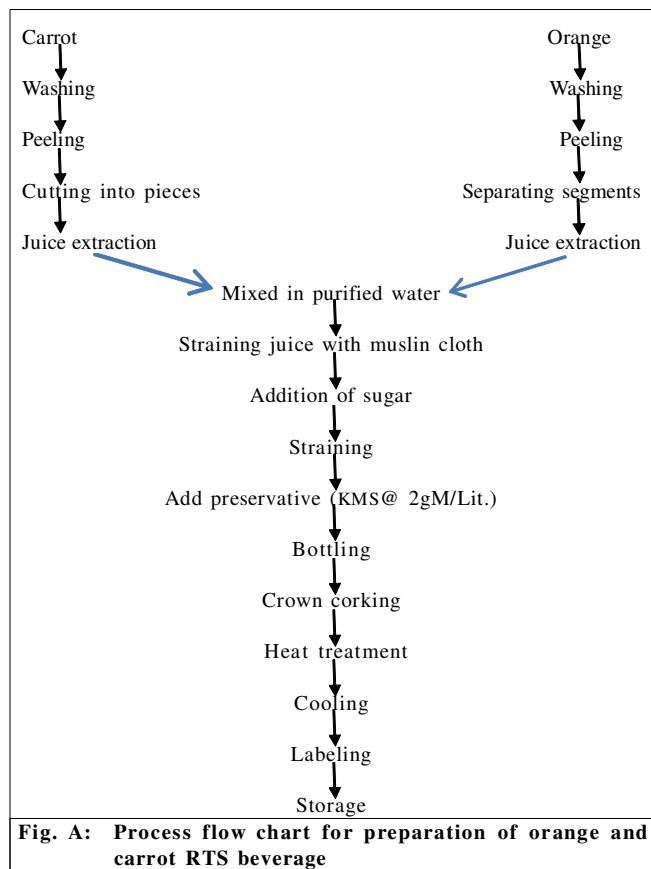
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Fruit most commonly used for preparing beverages are sweet orange, mandarin (*sangtra*), sour lime (*kagzinimboo* or *limboo*), lemon, grape fruit, grape, apple, mango, pomegranate, phalsa (*Grewi asiatica*), jamun (*Eugenia jambolana*), mulberry, passion-fruit, pineapple, etc. Among the squashes, sweetened orange juice known as orange squash and pineapple squash are the most popular ones (Sharma *et al.*, 2008). These product are marked under variety of name such as fruit drinks, breakfast drink, ready-to-serve (RTS), nectar, ready-to-drink (RTD) and squash etc. Orange is a citrus fruit, considered to be a hybrid, of ancient cultivated origin, between pomelo (*Citrus maxima*) tangerines (*Citrus reticulata*). Its consumption is as popular in the raw, peeled form, and as extracted juice. Rind of orange is used by people in recipes, either for flavoring or for garnishing purposes. Being rich source nutrients, orange has been associated with a number of health and nutrition benefits. The orange contain copper, fats, fibre, folic acid, iron, sodium and sulpharet. Carrot contain good amount of dietary fibre which has laxative effect and aids in digestion and absorption of nutrients and prevents constipation. Carrot roots are well known for their nutritional constituents like carotenoids especially β -carotene which act as a precursor of vitamin A. β -carotene also act as antioxidants by quenching single oxygen and triplet excited states (Baramanray *et al.*, 1995). Vitamin A also helps to form and maintain healthy teeth, skeletal and soft tissue, mucous

membranes and skin. In addition, a carrot satisfies 10 per cent of the average daily requirements for vitamin C, 8 per cent of dietary fibre needs, 6 per cent of potassium needs and 2 per cent of calcium needs with about 26 calories and 0 per cent fat. It is grown extensively in various countries during winter season in tropical region while during summer season in temperate countries (Kalra *et al.*, 1987). Carrot can enhance the quality of breast milk and improve the appearance of the skin, hair and nails. When taken daily it can lower cholesterol and blood pressure. Raw carrot contains α -carotene, a strong antioxidant that can prevent cancer.

■ METHODOLOGY

Fresh, fully ripened, uniform sizes orange and carrot were procured from local market of bulandshahr (U.P.). Orange and carrot free from disease and insect infections were selected for the investigation. Other raw materials included sugar, glass bottles, chemicals and preservatives used for sample preparation. Procured orange and carrot were washed, wiped and then extract the juice. Experiments were conducted at Agricultural Food Processing Lab (Marathwada Institute of Technology, Bulandshahr) and SVPUA and T, Meerut. Studies were also carried out to evaluate the quality of beverage at 0, 15, 30 and 45 days of storage. RTS sample were packaged in glass bottles of 200 ml size with leaving head space. All samples were stored at room temperature and home refrigeration (refrigerator).



Preparation of orange and carrot RTS beverages :

The RTS beverage was prepared from the orange extract and carrot juice in the ratio of (O₄₀:C₆₀, O₅₀:C₅₀ and O₆₀:C₄₀) and adjusted 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 and mixed water. The beverage filled in to the bottle leaving a head space of 2.5 to 3.0 cm, crown corked and processed in water for 20 to 25 min at 85 °C and cooled in cold water. Labeled bottles were stored at room temperature and refrigeration. The pH, TSS and acidity of samples were analyzed as recommended by (Pandey 2004 and Ranganna, 2001).

Total soluble solid :

TSS (°Brix) of carrot and orange RTS beverages was measured by refractometer of range of 0-32 °Brix and for measuring TSS of orange squash, frozen orange juice concentrate and refrigerated orange juice concentrate. 28-56 °Brix range refractometer was used. Using the method recommended by (Srivastava and Kumar, 2002). A brief description is given below. A drop of sample was placed on the prism and the observation was taken in front of sun light. The visible scale showed a dark line indication measuring TSS in degree °Brix.

Acidity :

The acidity of orange and carrot RTS beverage was estimated a method described by Srivastava and Kumar, 2002. 5ml sample was placed in 100ml distilled water, placed for heating for some period and a shake well and filtrate. Filtrate volume of aliquot was taken and was titrated with 0.1N NaOH using phenolphthalein as indicator. The endpoint was denoted by the appearance of pink colour. The titration was repeated thrice and the average value was recorded.

$$\% \text{ Acidity} = \frac{\text{Titre} \times 0.1 \times 0.064 \times 100}{\text{Wt. of sample taken} \times 1000}$$

pH:

pH is the measurement of the logarithm of inverse of hydrogen ion concentration in the solution.

$$\text{pH} = -\log (\text{H}^+)$$

where,

(H⁺) = hydrogen ion concentration (g\lit)

The electronic pH meter (make: Systronic μ pH system-361) was calibrated using 7 pH and 4 pH standard buffer solutions. Then electrode was dipped in the test solution and the temperature knob was adjusted to temperature of test solution. The function selector switch was set to pH and reading of digital display was allowed to stabilize.

Evaluation of overall acceptability

A hedonic rating test method was used for the evaluation of overall acceptability recommend by Pandey, 2004. A panel consisting of member of different age and different eating habit was constituent to evaluate the quality through properly-planned experiment. The panelists were selected from the staff and student of the department. Sample were served to the panelist, they were asked to rate the acceptability of the product through the sense of organs. Overall acceptability based as the average data of colour, texture, flavor and taste of the products evaluated the panelist. The hedonic rating scale ranged from extremely like (09) to extremely dislike (01). A test performa was also prepared and givento panelist before evaluation recommended by Pandey, 2004.

Rating(s)	Score
Like extremely	09
Like very much	08
Like moderately	07
Like slightly	06
Neither like nor dislike	05
Dislike slightly	04
Dislike moderately	03
Dislike very much	02
Dislike extremely	01

RESULTS AND DISCUSSION

The effect of proportion of orange and carrot juice, storage period and storage conditions on TSS, pH, acidity and overall acceptability of RTS beverage were analysed. The data TSS, pH, acidity and OAA are discussed in following section.

Effect on total soluble solid :

The data on TSS of RTS beverage preparing was different proportion of orange and carrot is presented in Table 1 and Fig 1 and 2 show that the highest TSS of beverage was found 13 °brix for O₄₀:C₆₀ and O₆₀:C₄₀ sample just after preparation which stored at room temperature and refrigeration, respectively. TSS of sample at room temperature was observed highest 14.7 °brix for O₄₀:C₆₀ and lowest 14.1 °brix for O₆₀:C₄₀ after storage of 45 days of storage. The result revealed that the TSS of beverage at room temperature increased rapidly with storage period. At refrigeration conditions, TSS of beverage was found highest 14.4 °brix for O₄₀:C₆₀ and lowest 13.3 °brix for O₆₀:C₄₀ at 45 days of storage. The TSS was increased moderately with storage period as compared to room temperature. The result of the study revealed that the proportion of carrot juice in beverage affected the TSS and decreased with decreasing the proportion of carrot juice from 60 to 40 per cent. The TSS of beverage stored under refrigeration was found lower TSS compared room temperature storage. The increased in TSS may be due to the fact that the carrot juice has more TSS as compared to orange juice. Similar trends were reported by (Yadav *et al.* (2012) Baramanray *et al.*(1995) Kalra *et al.*(1987).

Effect on acidity :

The experimental data of acidity of orange and carrot

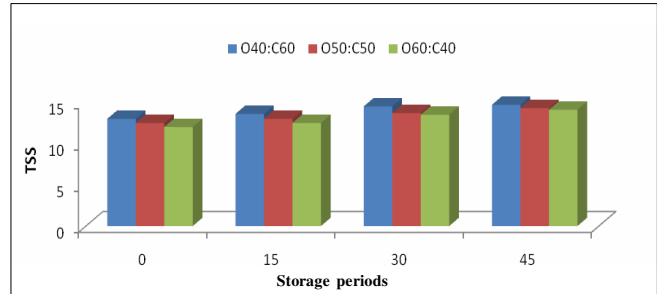


Fig 1: Changes in TSS of the samples of RTS beverage during room temperature

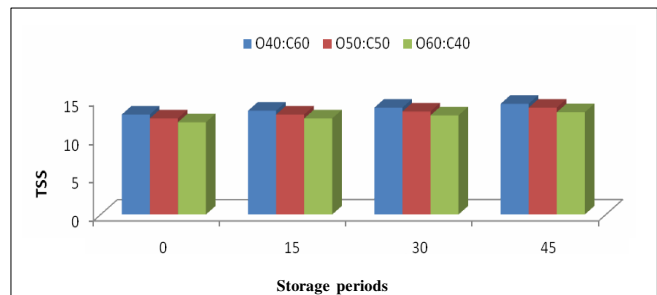


Fig 2: Changes in TSS of the samples of RTS beverage during refrigeration

based RTS beverage Table 2 and Fig 3 and 4. The acidity of the samples having orange and carrot based beverage, the juice ratio O₄₀:C₆₀, O₅₀:C₅₀ and O₆₀:C₄₀ were observed as (0.125, 0.128 and 0.130 %) respectively in the fresh samples. During storage, it can be seen (Table 2) that the acidity of all the samples was increased at 0, 15, 30 and 45 days of storage. The acidity values of the sample O₄₀:C₆₀, O₅₀:C₅₀ and O₆₀:C₄₀ after 45 days of storage were found as 0.155, 0.165 and 0.170 per cent at

Table 1: Qualitative analysis data of TSS during storability on different storage conditions

Stored period (days)	TSS					
	Room temperature			Refrigeration temperature		
	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀
0	13.0	12.5	12.0	13.0	12.5	12.0
15	13.6	13.0	12.5	13.5	13.0	12.5
30	14.5	13.7	13.5	13.9	13.4	12.9
45	14.7	14.3	14.1	14.4	13.9	13.3

Table 2: Qualitative analysis data of acidity during storability on different storage conditions

Stored period (days)	Acidity %					
	Room temperature			Refrigeration temperature		
	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀
0	0.125	0.128	0.130	0.125	0.128	0.130
15	0.140	0.145	0.155	0.130	0.135	0.140
30	0.150	0.154	0.160	0.135	0.140	0.150
45	0.155	0.165	0.170	0.140	0.145	0.155

room temperature and 0.140, 0.145, and 0.155 per cent under refrigeration, respectively. The result revealed that the acidity of beverage was increased with increasing the level of orange juice as compared to carrot juice. The acidity were also increased with increasing the storage period. The acidity was observed highest at room temperature as compared to refrigeration condition. It is clear that the temperature accelerated the biochemical reaction takes place in the

beverage during storage and increased the acidity of the samples. This increment in the acidity may be due to orange juice has more acidity as compared to carrot juice. Similar trends were reported by Yadav *et al.* (2012), Chen *et al.* (1996).

Effect on pH :

The data for pH of RTS in presented Table 3 and Fig. 5 and 6 show that the highest pH of beverage was found 2.99

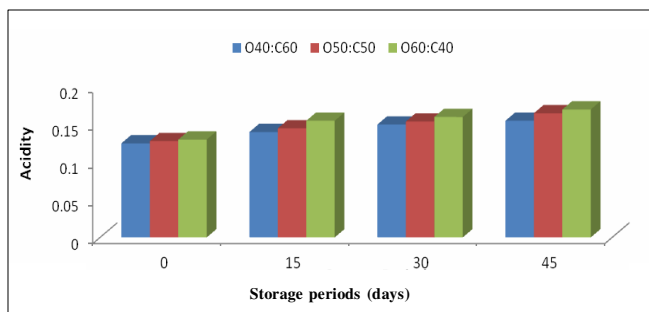


Fig 3: Changes in acidity of the samples of RTS beverage during room temperature

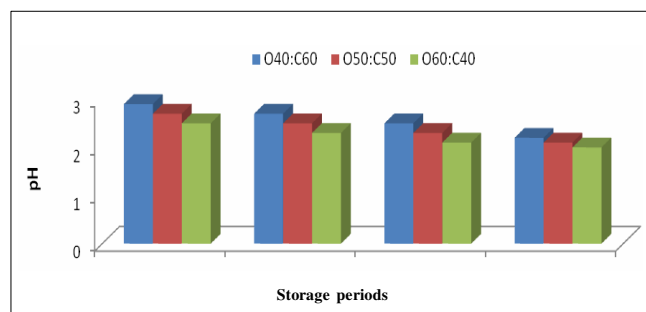


Fig 5: Changes in pH of RTS beverage during room temperature

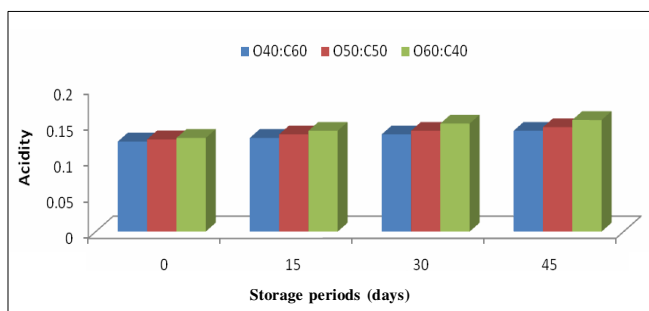


Fig 4: Changes in acidity of the samples of RTS beverage during refrigeration temperature

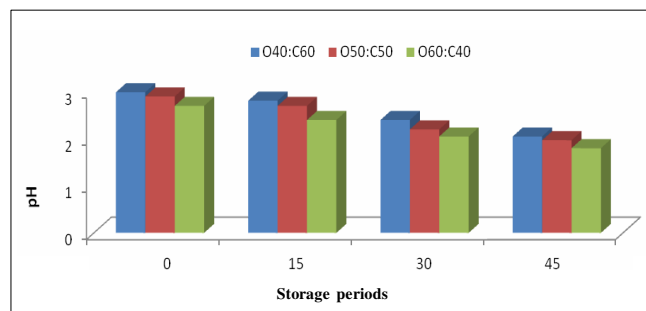


Fig 6: Changes in pH of RTS beverage under refrigeration

Stored period (days)	pH					
	Room temperature			Refrigeration temperature		
	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀	O ₄₀ :C ₆₀	O ₅₀ :C ₅₀	O ₆₀ :C ₄₀
0	2.99	2.70	2.50	2.99	2.70	2.50
15	2.70	2.50	2.30	2.81	2.55	2.40
30	2.50	2.30	2.10	2.40	2.20	2.05
45	2.20	2.10	2.00	2.05	1.97	1.80

Stored period (days)	Overall acceptability					
	O ₄₀ :C ₆₀		O ₅₀ :C ₅₀		O ₆₀ :C ₄₀	
	Room temp.	Refrigeration	Room temp.	Refrigeration	Room temp.	Refrigeration
0 (Fresh)	8.05	8.05	7.90	7.90	7.73	7.73
15	7.27	7.65	7.25	7.7	7.12	7.37
30	5.97	6.95	6.37	6.87	6.35	7.27
45	4.92	6.22	6.22	6.22	5.60	6.67

for $O_{40}:C_{60}$ sample just after preparation. The pH of sample under refrigeration was observed highest 2.20 for $O_{40}:C_{60}$ and lowest 1.80 for $O_{60}:C_{40}$ after storage of 45 days of storage. The result revealed that the pH of beverage under refrigeration lowered rapidly with storage period up to 45 days of as compared to room temperature. At room temperature, pH of beverage was found highest 2.20 for $O_{40}:C_{60}$ and lowest 2.00 for $O_{60}:C_{40}$ after 45 days of storage. The pH was decreased moderately with storage period as compared to room temperature. The result of the study revealed that the proportion of carrot juice in beverage influenced the pH and decreased with decreasing the proportion of carrot juice from 60 to 40 per cent. The pH of beverage under refrigeration was found lower pH as compared room temperature storage. The reduction in pH of beverage may be due to increasing the acidity of beverage due to biochemical reaction takes place. Similar trends were formed by Yadav *et al.* (2012) and Chen *et al.* (1996).

Overall acceptability :

Consumer acceptability were evaluated for all fresh as well as stored samples after 0, 15, 30 and 45 days. Overall acceptability in based on the consumer acceptability of beverage which includes the recommended data of colour, taste, texture and flavour. The data for overall acceptability and RTS beverage are given Table 4 and Fig 1- 9. OAA was recorded highest for $O_{40}:C_{60}$ (8.05) and lowest for $O_{60}:C_{40}$ (7.73) just after preparation. The per cent proportion of orange juice

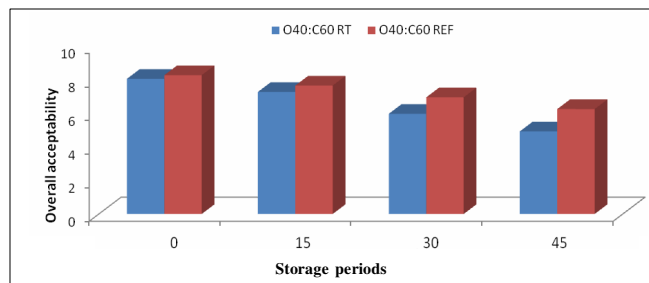


Fig 7: Changes in overall acceptability of the samples ($O_{40}:C_{60}$) of RTS beverage during refrigeration and room temperature

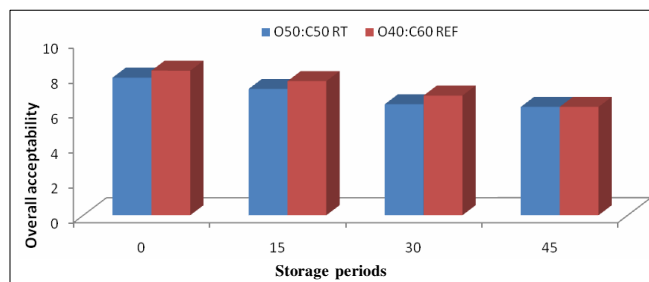


Fig 8: Changes in overall acceptability of the samples ($O_{60}:C_{40}$) of RTS beverage during refrigeration and room temperature

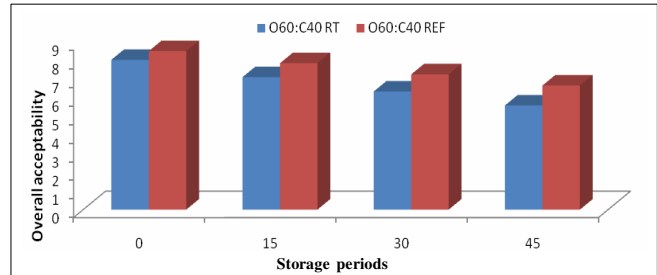


Fig 9: Changes in overall acceptability of the samples ($O_{60}:C_{40}$) of RTS beverage during refrigeration and room temperature

decreased the OAA in all combination of RTS beverages. After 45 days of storage, OAA was rated highest for $O_{60}:C_{40}$ (6.67) under refrigeration as compared to room temperature for $O_{50}:C_{50}$ (6.22) while lowest was scored 4.92 for $O_{40}:C_{60}$ under room temperature which was unacceptable at 45 days of storage. The study revealed that the OAA of RTS beverage was decreased rapidly during storage under room temperature and refrigeration. The OAA score decreased with increasing storage periods. In last the RTS beverage made from $O_{60}:C_{40}$ under refrigeration was found superior after 45 days of storage.

Conclusion :

The orange and carrot based RTS beverage of sample $O_{40}:C_{60}$, $O_{50}:C_{50}$ and $O_{60}:C_{40}$ at room temperature and refrigeration storage condition were acceptable up to 45 days. However, the RTS samples stored at refrigeration condition was found superior over other storage condition followed by room temperature conditions. During storage, acidity of samples increased with increase in the storage period. This increase in the acidity may be due to the fact that the orange juice more vitamin c in comparison to obtained from carrot juice. The pH of orange and carrot based RTS beverage decreased during storage period. This increase in the TSS may be due to the fact that the carrot juice more TSS in comparison to obtained from orange juice ratio as well as with increase in the storage period. The overall acceptability (OAA) of RTS decreased with increase in storage period. Results of study concluded that RTS beverage was found superior under refrigeration condition as compared to room temperature.

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