

Evaluation of Quality Attributes of Carrot and Grape Blend Juice

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Abstract:- Experimental study was conducted to evaluate the qualitative attributes of mixed juice using carrot and grape prepared with the composition of 90:10, 80:20 and 70:30 and the samples were stored at refrigeration temperature (5 °C), B.O.D. (25 °C) incubator condition and room temperature (35 °C) for 0, 15, 30 and 60 days. The physico-chemical qualities (TSS, pH and vitamin C), sensory quality (color, taste, flavor, texture and overall acceptability) and microbial growth were evaluated for just fresh blend juice and after 15,30 and 60 days. The study revealed that TSS increased with increase in storage period in all treatments. The TSS value scored maximum as 14.7, 14.6 and 14.3°Brix at room temperature after 60 days of storage period for carrot and grape blend juice composition 90:10,80:20 and70:30 respectively. The pH values of the sample composition 90:10, 80:20, and 70:30 after 60 days of storage were observed as 4.02, 3.97 and 3.93 at room temperature and 3.90, 3.81 and 3.74 at B.O.D. incubator condition respectively. It was observed that pH of all the samples were decreased at 15, 30, and 60 days of storage. Decrease in the vitamin C was observed with increase in the level of storage period for all samples of carrot and grape blend juice composition. The ascorbic acid values of the samples composition 90:10, 80:20 and 70:30 after 60 days of storage were observed as 5.22, 5.14 and 5.05 mg/100ml at room temperature condition. Similarly the ascorbic acid values of the samples composition 90:10, 80:20 and 70:30 after 60 days of storage were observed as 5.09, 5.01 and 4.89 mg/100ml at B.O.D. incubator condition respectively. The microbial growth increases with increase in storage period for all the treatments. The beverage samples stored at refrigeration condition was found superior over other storage condition followed by BOD incubator and room temperature conditions. Sensory panel recommended best sample containing 70:30 ratio of carrot and grape juice as taste, color and texture point of view with the score of overall acceptability (8.5) at refrigeration condition.

Key words: Blended juice, physico-chemical, microbial-growth, sensory.

I. INTRODUCTION:

Vegetables are important part of healthy eating and provide a source of many nutrients, including potassium, fibre, foliate (folic acid) and vitamins A, E and C. Broccoli, spinach, tomatoes and garlic provide additional benefits, making them a super food. India is a second producer of fruits and vegetables after China. India produced 191.77 million metric tonnes vegetables from an area of 10.292 million hectare (National Horticulture Board, 2019-20). The total area under Carrot crop in India during 2018-19 was 109 thousand hectare and the production was 1893 thousand metric tonnes (Horticultural Statistics, 2019). Carrot (*Daucus carota*) is a worldwide root vegetable that is highly nutritional, and an important source of carotene besides its appreciable amount of vitamins and minerals often used for juice production. A steady increase of carrot juice consumption has been reported in many countries (Schieber *et al.*, 2002). Dietz and Gould (1986) studied the effect of processing on beta carotene content of carrot juice and tomato juice and found that canning resulted in higher loss of beta carotene than pasteurization. Fruits being a seasonal crop by nature have prompted many scientists to embark on researches on how to process fruit juices and preserve them for usage during off-season. Nutritional, chemical composition and the effect of storage on various fruits (orange, pineapple and cashew apples) and their juices have been reported by Oguntola and Akinyele (1995). Fruit juices are liquid, non-alcoholic products with certain degree of clarity and viscosity obtained through pressing or breaking up of fruits with or without sugar or carbon dioxide addition. Fruits and its juices constitute one of the most important foods for man. The regular consumption maintains health and makes up for the losses in the human diet (Costescu *et al.*, 2006). Juice blending is one of the best methods to improve the nutritional quality of the juice. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used (De Carvalho *et al.*, 2007). Kumar and Kumar (2019) standardized carrot and orange blend juice in ratio 95:05, 90:10 and 85:15 and sensory panel recommended the blend in 85:15 to be the best with overall acceptability of 8.45 on 9 point hedonic scale.

Grape (*Vitis Vinifera*) is a fruit, botanically a berry and a deciduous crop belongs to the family of *Vitaceae*, originated in Western Asia and Europe. Ripe fruits are supposed to be the best table fruit. Its fruit contains a large proportion of sugars and minerals. Fruits are used for making wines and juices. The grape juice is a nourishing, thirst-quencher, a stimulant to the kidneys and laxative. It is one of the most consumed fruit juice world wide particularly appreciated by consumers for its organoleptic properties and its high content of potentially beneficial bioactive components. The total area under grape crop in India during 2018-19 was 140 thousand hectare and the production was 3041 thousand metric tonnes (Horticultural statistics, 2019). Masoodi *et al.* (1992) reported decrease in acidity from 0.65 to 0.63 percent during 24 weeks in stored grape juice. Gopalan *et al.* (1995) reported that physico-chemical composition of grape (blue variety) has moisture (82.2%), crude protein (0.6%), fat

(0.4%), crude fibre (2.8%), minerals (0.9%), carbohydrates (13.1%), energy (58 Kcal), calcium (20mg/100g), phosphorus (23mg/100g), iron (0.5mg/100g), carotene (3 μ g/100ml), thiamine (0.04 mg/100g), riboflavin (0.03 mg/100g), niacin (0.2 mg/100g) and ascorbic acid (1 mg/100g). Saxena *et al.* (1996) found that acidity of RTS beverage prepared from grape, mango blend decreased slightly with corresponding increase in Brix: acid ratio. Deka (2000) found highest total sugars of 9.53 percent in grape: mango (95:5) followed by mango: pineapple (85:15) and lime: aonla (95:5) RTS beverage. The higher total sugars content in grape: mango (95:5) might be due to the higher sugar content in grape juice (15.9%) and mango pulp (13.7%) as compared to other fruit juices. Deka *et al.* (2001) blended fruit juice/ pulp of lime, aonla, grape, pineapple and mango in different proportions (5 to 95 %) for preparation and standardization of ready to serve (RTS) beverages. Evaluation of soy/carrot drinks flavoured with beetroot was studied by Banigo *et al.* (2015) with the aim of developing new product or improving the existing one in the market. In view of the about study was under taken to evaluation of quality attributes of carrot and grape blend juice.

II. MATERIALS AND METHODS:

Fresh carrots and grapes consist essentially of an amount of 10 to 15 % juice. They are sweetened at least 10° Brix with a maximum acidity of 39%. Fresh carrot and grape were purchased from local market in Etawah. The carrots were washed with tap water, and peeled using Sodium hydroxide (40 g/l) at 95°C for 1 min then washed again in tap water. This was followed by blanching in citric acid solution (60 g/l) at 95°C for 5min then cooled in iced water to inactivate their endogenous enzymes and soften their tissues. At the end, they were sliced and grounded with addition of distilled water 1:1 (v/w) and filtered on cheese cloth under vacuum to get fresh juice. Grapes were cleaned with tap water, peeled and then grape juice was extracted using juice blender. After that the juice of carrot and grape juices should be blended in different ratios of 90:10, 80:20, and 70:30 respectively. After citric acid and ascorbic acid added to juice properly and then mixture filtered through muslin cloth. After that juice should be filled in glass bottles which should be sterilized at 110°C for 10 minutes, then sealed after that bottles should be pasteurized at 90°C for 25 sec., respectively. Glass bottles were cooled at room temperature. Labeled bottles was stored at different temperature in different condition. Sample containing different fruit juices ratio *viz.*, 90:10, 80:20, and 70:30 of carrots and grapes were prepared and evaluated by the sensory panel. Panel recommended sensory score for all three compositions *viz.*, 90:10, 80:20 and 70:30 of Carrots and grape blend juice. Storage studies under room temperature, refrigeration temperature and B.O.D. incubator temperature were conducted. Physico-chemical (TSS, pH and vitamin C) Sensory characteristics (colour, flavour, taste, texture and overall acceptability) and microbial growth studies were also conducted to best Carrots and grape blended juice having best qualities and best storage period.

The value of total soluble solid (TSS) was determined by the hand refractometer. TSS (°Brix) measurement was done with the help of refractometer as recommended by Srivastava and Kumar (1994). Digital pH meter was used to determine the pH of the sample of blended juice with highest acceptability. The electronic pH meter (Elico, LI127) was calibrated using 7 pH and 4 pH standard buffers 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. Samples of carrot and grape blend juice were analyzed for the ascorbic acid content using 2,6-Dichlorophenol indophenols dye titrimetrically as per the modified procedure of AOAC (1985). The evaluation of sensory attribute *viz.*, colour, flavour, taste, texture and overall acceptability by a panel of judges using 9- point hedonic scale (Ranganna, 2001). The sensory evaluation was quantified using a sensory evaluation card in which the grades of different samples for different properties was awarded by the panel of judge. Total plate count (TPC) procedure was used to determine the number of microorganism in the blended juice. It is an agar plate method for estimating population of bacteria. The serial dilution (90:10, 80:20, and 70:30) of the fresh juice blend was prepared 1 ml of each dilution was transferred to sterilized petri plates, 10ml of the sterilized cooled agar medium was added to each plate and each plate was rotated gently, immediately after addition of the medium for uniform distribution of the organism and the agar plate was allowed to solidify. These steps were repeated for the processed juice blend after 15 days, 30 days and 60 days. All the plates were incubated at 37 °C for 48 hrs. The plates was examined for bacterial colonies and the number of colonies formed in each plate was counted using colony count, of both fresh and processed juice blend sample. Colony count was used to count forming units (cfu) of micro-organism. The experiment was conducted by adopting Completely Randomized Design of the data recorded. During the course of investigation, product of different formulations was analyzed satisfactory by the analysis of variance (ANOVA). The significant factor of treatment was judged with the help of (variance ratio). F value was compared with the table value F at 5% level of the significance. If calculated value exceed the table value, the effect is considered to be significant. The significance is tested at 5% level.

III. RESULTS AND DISCUSSION:

The study was undertaken to develop blended juice using carrot and grape. Qualitative analysis was done during storage period at different temperature. Juice blends were prepared with various combinations of carrot and grape juice as 90:10, 80:20 and 70:30. For the evaluation of quality of juice of carrot and grape, several physico-chemical parameters *viz.*, TSS, pH, vitamin C and microbial studies (TPC) and sensory parameters (Colour, Taste, Flavour, Texture and overall acceptability) were evaluated. Juice samples were packed in pasteurized glass bottles. Evaluation of quality parameters were carried out for fresh as well stored samples after

15, 30 and 60 days under the different storage conditions viz., room temperature, refrigeration temperature and B.O.D. incubator. Shelf life study of developed juices was conducted for total plate count. Results are discussed as follows:

The effect on TSS of different composition of carrot and grape blended juice was observed. Results showed that for all storage condition, the total soluble solid increased with increase of storage period in all composition of juice but TSS has been decreased simultaneously in juice composition 90:10, 80:20, and 70:30 in each storage period. The reason for decrease in TSS with increase of composition of grape juice may be attribute to the final moisture content of fresh samples as these two parameters have inverse relationship. The TSS value scored maximum as 14.7, 14.6 and 14.5°Brix after 60 days storage period at room temperature for blend ratio 90:10, 80:20 and 70:30 respectively. The minimum value of TSS 11.0°Brix of the fresh sample having ratio 70:30 was observed in Refrigeration Temperature ANOVA was generated for TSS, and it showed that storage condition and storage period have pronounced effect on TSS.

The effect on pH of different composition of carrot and grape based blended juice was observed. The pH of the samples of carrot and grape juice 90:10, 80:20 and 70:30 were measured as 4.31, 4.11 and 4.04, respectively, in the fresh samples initially at room temperature. The decrease in the value of pH was observed with either decrease in the ratio of carrot juice or increase in the ratio of grape juice in developed beverage. During storage, it was observed that pH of all the samples were decreased at 15, 30, and 60 days of storage. The pH values of the sample composition 90:10, 80:20, and 70:30 after 60 days of storage were observed as 4.02, 3.97 and 3.93 at room temperature and 3.90, 3.81 and 3.74 at B.O.D. incubator condition respectively. The decrease in pH may be due to the fact that pH has inverse relationship with acidity. The lowest pH (3.74) of the sample having ratio C₇₀:G₃₀ was observed in refrigeration temperature condition after 60 days of Storage. The decrease in pH was due to increase in titrable acidity which affects the organoleptic quality of juice (Bhardwaj, 2005). ANOVA showed that calculated value of F due to treatments is greater than the tabulated value of 5% probability level. Therefore it can be concluded that significant effect of treatments on pH content of samples was observed.

Effect on ascorbic acid of different carrot and grape blended juice was evaluated. The ascorbic acid of samples of blended juice ratio of 90:10, 80:20 and 70:30 were measured as 7.41, 7.06 and 7.01 mg/100ml, respectively of fresh sample at the room temperature. During storage, it was observed that ascorbic acid of all the samples was decreased at 15, 30 and 60 days of storage. The ascorbic acid values of the samples of the ratio carrot and grape 90:10, 80:20 and 70:30 after 60 days of storage were observed as 5.15, 5.07 and 5.01 mg/100ml at refrigeration condition, respectively. The ascorbic acid values of the samples 90:10, 80:20 and 70:30 after 60 days of storage were observed as 5.22, 5.14 and 5.05 mg/100ml at room temperature condition and the ascorbic acid values of the samples 90:10, 80:20 and 70:30 after 60 days of storage were observed as 5.09, 5.01 and 4.89 mg/100ml at B.O.D. incubator condition respectively. The lowest ascorbic acid 4.89 mg/100ml of the sample having ratio 70:30 was observed in B.O.D. incubator after storage 60 days. However, in general lower values of ascorbic acid for different samples were found lowest after 60 days of storage conditions. The decrease in ascorbic acid of the RTS samples during the storage might be due to oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) by trapped or residual oxygen in the glass bottles was reported by Panday (2004). The Vitamin C content may decrease as due to sensitiveness of heat and air. ANOVA showed that significant effect of treatments on vitamin C content of samples was observed.

Sensory qualities were evaluated for all fresh as well as stored samples after 15, 30 and 60 days. The samples were served to panelists. Colour, flavour, texture and taste were selected as sensory attributes on 9-point Hedonic scale. The scores awarded by the panelist for individual attributes and also the average of all attributes at 15, 30, and 60 days of storage. In general, decline in sensory score were observed in samples after 15, 30 and 60 days of storage period. In few cases, increases in score were also observed unexpectedly because of inconsistency of the samples were not very high. Data shows that after the storage of 60 days, all the samples were in fairly good condition. Overall sensory score after 60 days of storage was lowest (6.3) "Like slightly" at B.O.D. Incubation condition for samples 90:10 and highest (8.5) "Like very much" for fresh sample (70:30) at refrigeration condition. Fig. 1 shows the sensory score of attributes after storage of 60 days in refrigeration storage condition. The overall acceptability was obtained highest (8.5) in juice ratio 70:30 at refrigeration temperature after 60 days storage. Sharma *et al.* (2008) reported that studies of sensory evaluation of RTS beverages revealed that highest score was 7.55 recorded in (15% juice of 80:20 guava: papaya) and the lowest was 6.15 in (10% juice of 50:50 guava: papaya).

The microbial growth (TPC values) of the samples of different carrot and grape blended juice was observed as 1.06×10^5 cfu/ml, 1.04×10^5 cfu/ml and 1.03×10^5 cfu/ml of juice composition 90:10, 80:20 and 70:30 at room temperature after 60 days, respectively. The microbial growth of the samples of different carrot and grape blended juice were observed as 0.94×10^5 cfu/ml, 0.87×10^5 cfu/ml and 0.72×10^5 cfu/ml of juice composition 90:10, 80:20 and 70:30 at B.O.D. Incubator condition after 60 days, respectively. The microbial growth value after 60 days of storage was observed as 0.80×10^5 cfu/ml, 0.65×10^5 cfu/ml and 0.51×10^5 cfu/ml for the sample stored at refrigeration temperature condition of carrot and grape juice composition 90:10, 80:20 and 70:30, respectively. The study also revealed that as microbial growth increased with increase of storage period irrespective of storage conditions. The highest microbial growth was observed as 1.06×10^5 cfu/ml in case of sample having carrot and grape ratio 90:10 at room temperature condition after 60 days of storage. Saravana and Manimegalai (2005) reported the microbial load as $1-2 \times 10^6$ /ml bacteria, $1-2 \times 10^4$ /ml fungi and $1-2 \times 10^5$ cfu/ml yeast upto 90 days of storage in refrigeration condition which was considered safe for consumption. Therefore TPC value considered under safe limit. ANOVA showed that all parameters have significant effect on microbial growth.

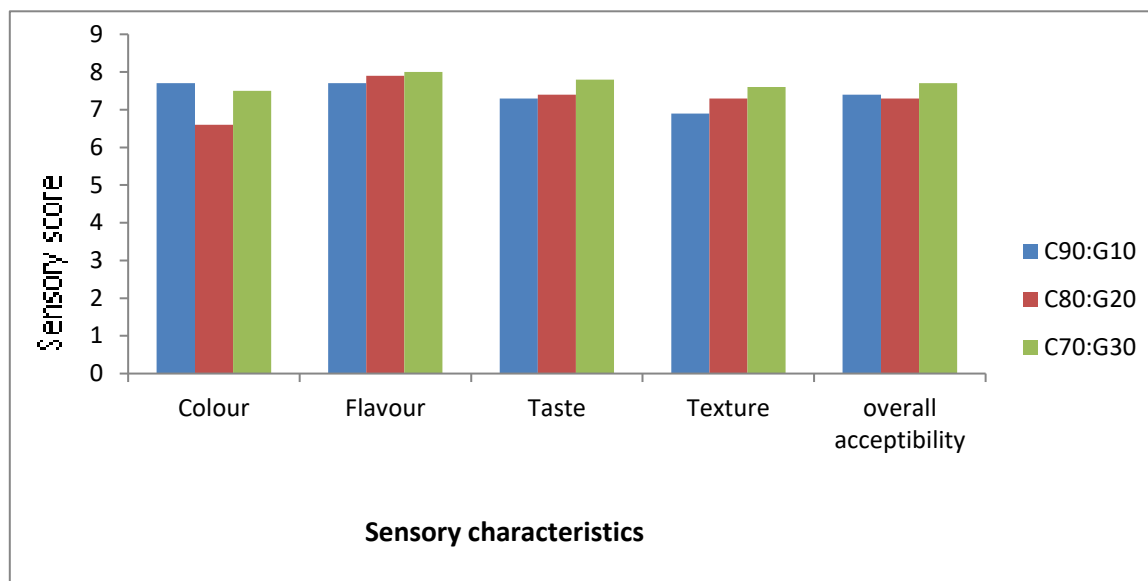


Fig. 1 : Effect of sensory attributes after storage of 60 days in refrigeration storage condition

IV. CONCLUSION:

Experiments were carried out to develop carrot and grape blended juice and qualitative evaluation of the product. The samples of carrot and grape based blended juice 90:10, 80:20 and 70:30 at room temperature, B.O.D. incubator and refrigeration storage condition were acceptable upto 60 days. However, the juice samples stored at refrigeration condition was found superior over other storage condition followed by BOD incubator and room temperature conditions. The pH of carrot and grape blended juice decrease during storage period. The lowest pH (3.74) was found of the sample in juice ratio 70:30 at B.O.D. incubator after storage of 60 days. TSS of carrot and grape blended juice increased slightly with increase in carrot juice ratio as well as with increase in the storage period. The highest TSS (14.7 °Brix) was found of the sample 90:10 at room temperature storage after 60 days. The lowest ascorbic acid 4.89 mg/100ml was obtained in the sample 70:30 at B.O.D. incubation after storage 60 days. The microbial growth increased during increases of storage period irrespective of carrot and grape juice ratio at different storage condition. The highest microbial growth was obtained as 1.06×10^5 cfu/ml in the sample 90:10 at room temperature condition after 60 days storage which was considered safe for consumption. Best sensory score of fresh beverage sample containing 70:30 ratio of carrot and grape juice as colour, taste, flavour and texture points of view with the score of overall acceptability 8.5 at refrigeration condition.

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