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Preparation and Storing Constancy Assessment of Orange Lemonade Drink

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Abstract

The orange lemonade drink was prepared in which different concentrations of preservatives (sodium benzoate and potassium metabisulphite) were added along with 10% sugar while some samples were sugar free in order to obtain the best combination. These samples were studied for physicochemical (pH, % acidity, TSS, ascorbic acid, reducing sugar and none reducing sugar) and organoleptic evaluation (colour, flavour, taste and overall acceptability). The results were studied and compared after interval of 15 days for total of 90 days storage period at room temperature. Ascorbic acid content decreased in all the samples during storage. The minimum loss in ascorbic acid content was observed in T8 (27.01%) and maximum in T0 (50.28%). Increase in titratable acidity was observed during storage. Maximum increase was observed in T6 (30.34%) while the minimum increase was observed in T1 (10.45%). pH was slightly decreased during storage. Maximum decrease was observed in sample T5 (3.82%) while minimum decrease was observed in sample T3 (1.25%). TSS was increased and maximum increase was observed in sample T4 (13.3%) and minimum in T3 (4.04%). Reducing sugar increased during storage. Maximum increase was observed in T7 (22.36%) while minimum in T4 (9.30%). Non reducing sugar considerably decreased. Maximum decrease was noticed in To (73.3%) while minimum in T4 (22.2%). Sugar acid ratio decreased during storage. Maximum decrease was observed in T5 (15.97%) while minimum in T0 (2.98%). Organoleptically for colour factor, T7 obtained maximum score (7.20) while minimum was obtained by T0 (6.57). Results for statistical analysis for 90 days storage and internal comparison were found significant (P<0.05).

Keywords: Preparation; Concentration of preservatives; Organoleptic assessments

Introduction

Citrus fruit is botanically a hesperidium a particular kind of berry with leathery rind and divided internally into segments. The orange is a hybrid of ancient cultivated origin, possibly between pomelo (*Citrus maxima*) and tangerine (*Citrus reticulata*). It is a small flowering tree growing to about 10 m tall with evergreen leaves, which are arranged alternately, of ovate shape with crenulate margins and 4–10 cm long. The orange fruit is a hesperidium, a type of berry. Oranges originated in Southeast Asia. The fruit of *Citrus sinensis* is called *sweet orange* to distinguish it from *Citrus aurantium*, the bitter orange. In a number of languages, it is known as a "Chinese apple" (e.g. Dutch *Sinaasappel*, "China's apple", or "Apfelsine" in German). The name is thought to ultimately derive from the Dravidian word for the orange tree, with its final form developing after passing through numerous intermediate languages. (Wikipedia, the encyclopedia) Citrus ranks second to apple in world trade. Citrus is grown throughout the world in tropical and subtropical climates. The soil and climatic conditions of Pakistan especially N.W.F.P are congenial for the production of citrus fruits [1]. The important varieties produced are Oranges *(citrus sinensis osbeck)* and Lemon *(citrus lemon burman)*. The reproductive tissue surrounds the seed of the angiosperm lemon tree. The lemon is used for culinary and nonculinary purposes throughout the world. The fruit is used primarily for its juice, though the pulp and rind (zest) are also used, primarily in cooking and baking. Lemon juice is about 5% (approximately 0.3 moles per liter) citric acid, which gives lemons a tart taste, and a pH of 2 to 3. This makes lemon juice an inexpensive, readily available acid for use in educational science experiments. Lemons are also known for their sourness. Because of the tart flavor, many lemon-flavored drinks and candies are available on the market, including lemonade (Wikipedia, the encyclopedia). Large numbers of industries have started processing these fruits into pure citrus juice and ready to drink juices etc. strong national and international demand for citrus products will provide stimulus to maintain increasing levels of production. Citrus fruits are the rich source of vitamin C. about 80% of the vitamin C in our diet comes from citrus fruits [2]. Horticultural crops not only provide human beings with nutritional and healthy foods, but also generate a considerable cash income for growers in many countries. However, horticultural crops typically have a high moisture content, tender texture, and high perishability. If not handled properly, a high-value nutritious product can deteriorate and rot in a matter of days or even hours. Therefore, a series of sophisticated technologies have been developed and applied in post-harvest handling of horticultural crops in the last few decades. Unfortunately, many Asian countries have not been able to use this advanced equipment, owing to cost or adaptability problems. Post-harvest losses, therefore, remain high [3].

Beverages are one of the important food items in our diet providing vitamin C and other nutrients to our body. Citrus juices are the emerging beverages which can be prepared by using the appropriate combinations of sucrose. The first artificial sweetener introduced for commercial use was saccharin [4]. Other sweeteners have been used commercially and many synthetic sweeteners have been introduced.

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However, at the present time saccharin is the only nutritive sweetener approved by the Food and Drug Administration for use in foods and beverages in the United States [5]. Global fruit and vegetable juices market sets sights on 53 billion liters by 2010, according to new report by Global Industry Analysts, Inc. Fruit and vegetable juices market is witnessing excellent growth primarily due to the increasing target audience focusing on health and nutritional issues. Juices represent one of the most competitive segments in the beverages industry vying intensely with alternative beverages such as bottled water, RTD drinks, sports and energy drinks and various other herbal concoctions promising a unique taste and flavor. World market for fruit and vegetable juices is forecast to reach 53 billion liters by 2010. Per capita consumption of fruit juices has been witnessing rapid growth, primarily driven by rising awareness over the importance of maintaining healthy and nutritious eating habits. Declining consumption of alcohol and the switch towards nonalcoholic beverages, advent of new products such as chilled and vitamin-fortified juice blends, and rising popularity of juices fortified with fiber, calcium and vitamins are expected to push up sales in the market. Worldwide fruit and vegetable juices market is portended to reach 53 billion liters by 2010, as stated in a recent report published by Global Industry Analysts, Inc. North America and Europe represent leading markets, accounting for about 60%. However, maximum growth is anticipated from Asia-Pacific, which is set to be the fastest growing market [6]. Global fruit juices market dominated the worldwide market for fruit and vegetable juices, capturing about 94% share. In chilled ready to serve juices market, European market is forecast to reach 11.3 billion liters in 2010. In vegetable juices market, the US is forecast to generate about 492 million liters in 2010. Flavor, price, and brand image are critical factors influencing purchasing decisions of consumers. Fruit and Vegetable Juices Market: A Global Strategic Business Report Major players in the marketplace include Del Monte Foods, Cadbury Schweppes, Minute Maid Company, Odwalla Inc, Nestle SA, Ocean Spray Cranberries, Tropicana Products Inc, and Welch Foods. Fruit and Vegetable Juices Market: A Global Strategic Business Report`, published by Global Industry Analysts, Inc., provides a comprehensive review of market trends, product profile, recent developments, mergers, acquisitions, profiles of major players and other strategic industry activities. Analysis is presented for major geographic markets such as US, Canada, Japan, France, Germany, Italy, the UK, Spain, Russia, Asia-Pacific, Latin America and Middle East. Analytics for the period 2000 through 2015 are provided in terms of product segments including fruit juices (frozen concentrates, chilled ready to serve juices and shelf stable juices) and vegetable juice [6]. Sodium benzoate may be used as a preservative (if declared on the label). Benzoic acid and sodium benzoate are generally regarded as safe up to a maximum permitted level of 0.1%. In most countries, the maximum permissible quantities generally range between 0.15-0.25 percent. Sorbic acid and its salt are some of the most widely used food preservatives in the world. As food preservatives, sorbates have found wide application in various foods, especially as yeast and mold inhibitors. Effective antimicrobial concentrations of sorbates in most foods are in the range of 0.05%-0.03%. In high sugar products (e.g. jams, jellies) smaller quantities of Sorbic acid are adequate for preservation, because of synergistic action of sorbet with sugar [7]. The use of benzoic acid as a food preservative has been limited to those products which are acid in nature. It is used as antimycotic agent, and most yeasts and fungi are inhibited by 0.05-0.1% of the undissociated acid. Food poisoning and spore forming bacteria are generally inhibited by 0.01-0.02% of undissociated acid, but many spoilage bacteria are much more resistant. Benzoic acid has been widely used to preserve beverages, fruit products, bakery products and other food products [8]. In the last decade there has been considerable increase in demand for ready to serve orange juice. Due to lack of preservation facilities in our country, this research will contribute.

The main objectives of the research

I. To study the effect of chemical preservatives on the preservation quality of ready to serve orange juice.

II. To determine the physicochemical changes taking place in the juice stored at room temperature.

III. The findings will help the beverage industry and consumers will have a juice with increase shelf.

Materials and Methods

Preparation of sample

After thoroughly washing the oranges and lemons, juice was extracted; this was used for the research. The juice was then passed through muslin cloth to remove any undesirable materials. Orange juice and lemon juice was mixed together in the ratio of 9:1 and then this drink was named “orange lemonade.” Sugar was added according to the likings of different people i.e. 25 gm in each sweetened bottled.

Proposed plan of study

Orange lemonade was than treated with sodium benzoate and potassium metabisulphite according to the following procedures:

T_o = orange lemonade (unpasteurized) + no-preservatives + no-sugar (control)

T_1 = orange lemonade + sucrose

T_2 = orange lemonade unsweetened + 0.1% sodium benzoate

T_3 = orange lemonade + sucrose + 0.1% sodium benzoate

T_4 = orange lemonade unsweetened + 0.1% potassium metabisulphite

T_5 = orange lemonade + sucrose + 0.1% potassium metabisulphite

T_6 = orange lemonade unsweetened + 0.05% sodium benzoate + 0.05% potassium metabisulphite

T_7 = orange lemonade + sucrose + 0.05% sodium benzoate + 0.05% potassium metabisulphite

T_8 = orange lemonade unsweetened + 0.05% sodium benzoate + 0.05 % potassium metabisulphite (unpasteurized)

T_9 = orange lemonade + sucrose + 0.05% sodium benzoate + 0.05% potassium metabisulphite (unpasteurized)

Storage

Preserved orange juice was stored for a period of three months at room temperature. This product was studied for physicochemical and organoleptic evaluation at interval of 15 days for a total period of 90 days.

Physicochemical analysis

Ascorbic acid: The ascorbic acid was determined by the titramitric method as described in AOAC [9].

Preparation and standardization of the dye solution: Fifty mg of 2, 6 dichlorophenol indophenols dye and 42 mg of sodium bicarbonate were weighed, dissolved in distilled water and volume was made up to 250 ml. 50 mg of standard ascorbic acid was taken in 50 ml of volumetric flask and the volume was made up with 0.4% oxalic acid. 2 ml of this ascorbic acid solution was titrated against dye solution until light pink color was obtained which persisted for 15 seconds.

Titration of the sample: Ten ml of the sample was taken in 100 ml of volumetric flask and volume was made up to the mark by adding 0.4% oxalic acid. 10 ml of prepared sample was taken in the flask and was titrated against dye until light pink color appeared, which persisted for 15 seconds. Three consecutive readings were taken for each sample.

Calculation: The ascorbic acid was calculated by using the following formula;

$$\text{Ascorbic acid } (\text{mg/100g}) = \frac{F * T * 100}{S * D}$$

$$F = \text{ Factor from standardization } = \frac{\text{ml of ascorbic acid}}{\text{ml of dye used}}$$

T = ml of dye used for sample

S = ml of diluted sample taken for titration

D = ml of sample taken for dilution

Titratable acidity %: Titratable acidity was determined by the standard method as reported in AOAC [9].

Standardization of the NaOH solution: About 6.3 g of oxalic acid was weighed dissolved in distilled water and the volume was made to 1000 ml by adding more distilled water. This is stock solution. About 4.5 g of NaOH pellets were taken and dissolved in distilled water and volume was made up to 1000 ml. The burette was then filled with roughly prepared 0.1 N NaOH. 10 ml of 0.1 N oxalic acid was taken in a conical flask in triplicate. Two or three drops of phenolphthalein as indicator were added to each conical flask. The 0.1 N NaOH oxalic acid was titrated against 0.1 N NaOH solutions until pink light color was appeared, which persist for 15 seconds. Three consecutive readings were taken and the normality of NaOH was calculated using the formula:

$$N_1V_1=N_2V_2$$

Where,

N_1=Normality of oxalic acid solution

V_1= Volume of oxalic acid solution

N_2= Normality of NaOH solution

V_2= Volume of NaOH solution

Titration of samples: Ten ml of the sample was taken in 100 ml volumetric flask and diluted up to the mark. 10 ml of these samples were taken in a titration flask and add two or three drops of the phenolphthalein as indicator, then titrated against exact 0.1 N NaOH solution, until light pink color appeared, which persisted for 15 seconds. Three consecutive readings were taken and acidity was calculated by using the formula.

$$\text{Acidity}(\%) = \frac{0.067 \; * \text{ ml of NaOH used } * 100 * \; 100}{A * B}$$

Where,

A= Sample taken for dilution

B= Sample taken for titration

pH: pH was determined by standard method of AOAC [9]. For the determination of pH of samples, the pH meter was used. First it was standardized by using buffer solutions of known pH (4 and 9) then 10 ml of sample was taken in a clean beaker and probe was directly dipped into the sample to record the pH value.

Total soluble solids: The Total Soluble Solids (TSS) was determined at room temperature by the recommended method of AOAC [9] using refractometer. The drop of representative sample was placed on the dry refractometer prism and readings were taken in "brix" while directing the prism towards light source, added the correction factor according to temperature.

Total sugars: Reducing sugar was determined by Lane and Eynon method as described in AOAC [9].

Reducing sugars:

i. Reagents: Fehling A: Dissolved 34.65 g of $CuSO_4.5\ H_2O$ in 500 ml of distilled water. Fehling B: 173 g of potassium tartarate and 50 g of NaOH were taken in beaker. About 100 ml of water was added and dissolved the chemicals by stirring. The solution was transferred to 500 ml flask and volume was made up to the mark with distilled water. Methylene blue was used as indicator.

ii. Procedure: Ten ml of sample was taken in 100 ml volumetric flask and made up to the mark with distilled water. The burette was filled with this solution. Then 5 ml of Fehling A and 5 ml of Fehling B solution along with 10 ml distilled water was taken in a conical flask. The flask was heated until boiling without disturbing the flask. Sample solution was added from the burette drop by drop while boiling until the color became brick red in flask. A drop of methylene blue was added as indicator in the boiling solution of without shaking the flask. If color changes from red to blue for a moment, reduction isn't complete and added more pulp solution till red color persisted.

iii. Calculations: The orange juice and lemon juice was mixed5 ml of Fehling A+5 ml of Fehling B will reduce, 0.05 g of reducing sugar.

5 ml of Fehling A+5 ml of Fehling B = X ml of 10 % sample solution = 0.05 g of reducing sugar 100 ml of 10 % sample solution will contain

$$\frac{0.05 \; * \; 100}{\text{X ml of 10 \% sample solution}} = \text{ Yg of reducing sugar}$$

$$\text{\% reducing sugar in sample} = \frac{Y * 100}{10}$$

Non-reducing sugar:

i. Procedure: Ten ml of the sample was taken in a volumetric flask and made the volume up to the mark with distilled water. 20 ml of this solution was taken in a flask and 10 ml of 1 N HCl was added, and then heated this solution for 5-10 minutes. After cooling 10 ml of 1 N NaOH was added and made this solution up to 250 ml. This sample solution was taken in a burette. 5 ml Fehling A and 5 ml Fehling B solution along with 10 ml of distilled water was taken in a conical flask and boiled. When boiling started, it was titrated against the sample solution from the burette till changed to red-bricked color. It is tested with methylene blue as indicator till brick red color persisted.

ii. Calculations

X ml of sample solution contains = 0.05 g if reducing sugar.

$$\text{250 ml of sample sol. Contains} = \frac{250 \; * \; 0.05}{\text{X ml}} = \text{ Y g of reducing sugars}$$

This 250 ml of sample solution was prepared from 20 ml of 10% solution.

So 20 ml of 10% solution contain Y g of reducing sugar.

$$100 \text{ ml of } 10\% \text{ solution contain} = \frac{Y * 100}{10} = P \text{ g of reducing sugar}$$

This 100 ml was prepared from 10 ml sample.

10 ml sample contain P g of reducing sugar.

$$100 \text{ ml solution contain} = \frac{P * 100}{10} = Q \text{ g of reducing sugar}$$

Q g of reducing sugar = inverted sugar + Free reducing sugar.

Non-reducing sugar = Total reducing sugar + Free reducing sugar.

Sugar/Acid ratio: TSS/acid ratio was determined by standard method as described in AOAC [9]. The TSS/Acid ratio was calculated by the following formula:

$$\text{Sugar / Acid ratio} = \frac{\text{Total soluble solids}}{\text{Total acidity}}$$

Organoleptic evaluation: Selected samples of juice were evaluated organoleptically for color, flavor, and overall acceptability by using 9-point Hedonic scale method as described by Larmond. Samples were presented to trained judges to compare them and assign them score between 1-9, where 1 represents extremely disliked and 9 represent extremely liked. Tap water was provided for oral rinsing.

Statistical analysis: All the data regarding different parameters were statistically analyzed by Randomized Complete Block Design (RCBD) as recommended by Steel and Torrie, 1980 and the means were separated by least significant difference (LSD) test [10].

Results and Discussions

Ascorbic acid

Initially the ascorbic acid content of samples (T_0 to T_9) was 35.0, 35.1, 34.7, 36.1, 34.8, 37.2, 34.7, 37.1, 34.8 and 37.0 mg/100 g, which was gradually decreased to 317.4, 19.5, 20.1, 21.0, 22.6, 24.4, 25.0, 26.0, 25.4 and 25.7 mg/100 g respectively during 90 days of storage period. The mean values of ascorbic acid content significantly (P<0.05) decrease from 35.65 to 22.71 mg/100 g during storage. For treatments maximum mean values were recorded in sample T_7 (31.94) followed by T_5 (31.81 mg/100 g), while minimum mean values were recorded in sample T_0 (26.64) followed by T_2 (27.75 mg/100 g). Maximum decrease was observed in sample T_0 (50.28%) followed by T_1 (44.44%), while minimum decrease was recorded in sample T_8 (27.01%) followed by T_6 (27.95%) (Table 1). The statistical analysis showed that all treatments and storage intervals had a significant effect (P<0.05) on ascorbic acid content of orange lemonade drink during storage. Similar results have been observed by Mehmood et al. [11] who found that ascorbic acid decreased in apple juice during storage. Zeb et al. [12] also found that ascorbic acid decreased in the grape juice during storage under room temperature. These results are in agreement with the findings of Kinh et al. [13] who recorded a decrease in ascorbic acid content in apple pulp (Table 2).

pH

Initially the pH values of the samples (T_0 to T_9) were 3.19, 3.17, 3.18, 3.19, 3.10, 3.14, 3.15, 3.18, 3.17 and 3.16 which gradually decreased to 3.13, 3.09, 3.15, 3.07, 3.02, 3.09, 3.12, 3.10 and 3.07 respectively during 90 days of storage. The mean pH value significantly (P<0.05) decreased from 3.16 to 3.09 during storage. For treatment maximum mean values were observed in sample T_3 (3.16) followed by T_o (3.14) while minimum mean value was recorded in sample T4 and T5 (3.09) followed by sample T8 and T9 (3.11). During storage maximum decrease was observed in sample T_5 (3.82%) followed by T_9 (2.84%), while minimum decrease was observed in sample T_3 (1.25%) followed by T_7 (1.88%) (Table 3). The statistical analysis revealed that storage intervals and treatments had a significant (P<0.05) effect on pH. Similar results were obtained by Zeb et al. [12] who reported pH decreases during processing and storage. As the pH decreased there was a proportional increase in acidity during storage of grape juice. The decrease in pH is due to increase in acidity during storage period. Our results are in agreement with the finding of Cecilia and Maia [14], who observed a decrease in pH of high pulp content apple juice during storage. This decrease may be due to the formation of free acids and pectin hydrolysis [15]. These results are in agreement with the findings of Saini and Pal [16], who observed a decrease in pH of kinnow juice. The increase in acidity might be due to acidic compound formed by the degradation of reducing sugar and pectin. Similar trend was also found during storage of canned orange juice by El Warraki et al. [17].

Total soluble solids (TSS)

The TSS values of samples (T_0 to T_9) on day first was 11.0, 19.0,

Treatments	Storage intervals (Days)							% Decrease	Means
	Fresh	15	30	45	60	75	90		
T0	35.0	32.8	29.4	26.7	23.9	20.0	17.4	50.28	26.46e
T1	35.1	33.8	30.1	28.3	24.9	22.2	19.5	44.44	27.70cde
T2	34.7	32.6	30.5	27.4	25.2	22.0	20.1	42.07	27.50de
T3	36.1	34.9	31.3	29.2	26.4	23.6	21.0	41.82	28.93bc
T4	34.8	32.7	31.5	28.3	26.2	24.1	22.6	35.05	28.60cd
T5	37.2	35.5	34.2	32.0	30.8	28.6	24.4	34.40	31.81a
T6	34.7	32.5	31.5	30.3	29.0	27.2	25.0	27..95	30.03b
T7	37.1	35.7	34.5	32.3	30.8	27.2	26.0	29..91	31.94a
T8	34.8	32.7	30.0	25.8	25.7	25.6	25.4	27.01	28.57cd
T9	37.0	35.7	32.5	32.5	31.2	28.5	25.7	31.87	31.87a
Means	35.65a	33.89b	31.55c	29.28d	27.41e	24.9f	22.71g		

Mean values followed by different letters are significantly (P<0.05) different from each other.

LSD value for storage interval = 1.164

LSD value for treatments =1.391

Table 1: Effect of storage intervals and treatments on ascorbic acid content of orange lemonade.

Treatments	Storage intervals (Days)							% Decrease	Means
	Fresh	15	30	45	60	75	90		
T0	3.19	3.15	3.13	3.12	3.15	3.14	3.13	1.91	3.14bc
T1	3.17	3.17	3.13	3.12	3.12	3.10	3.09	2.52	3.13de
T2	3.18	3.18	3.16	3.15	3.14	3.12	3.10	2.51	3.15ab
T3	3.19	3.17	3.16	3.14	3.14	3.17	3.15	1.25	3.16a
T4	3.10	3.10	3.07	3.09	3.10	3.09	3.07	0.96	3.09f
T5	3.14	3.12	3.10	3.08	3.07	3.07	3.02	3.82	3.09f
T6	3.15	3.15	3.12	3.11	3.11	3.13	3.09	1.90	3.12de
T7	3.18	3.13	3.12	3.11	3.14	3.12	3.12	1.88	3.13cd
T8	3.17	3.15	3.10	3.10	3.09	3.09	3.10	2.20	3.11e
T9	3.16	3.15	3.11	3.10	3.11	3.10	3.07	2.84	3.11e
Means	3.163a	3.147b	3.12c	3.112c	3.117c	3.113c	3.094d		

Mean values followed by different letters are significantly ($P<0.05$) different from each other.

LSD value for storage interval = 0.01268

LSD value for treatments = 0.01516

Table 2: Effect of storage intervals and treatments on pH of orange lemonade.

Treatments	Storage intervals (Days)							% Decrease	Means
	Fresh	15	30	45	60	75	90		
T0	11.0	11.2	12.5	12.5	12.5	12.6	12.6	12.6	12.13d
T1	19.0	19.0	19.5	19.6	19.8	19.8	19.9	4.52	19.51b
T2	10.5	11.0	11.1	11.3	11.5	11.7	11.7	10.25	11.26e
T3	19.0	19.2	19.2	19.4	19.4	19.6	19.8	4.04	19.37b
T4	11.0	11.5	12.0	12.1	12.2	12.5	12.7	13.3	12.00d
T5	18.5	18.6	19.0	19.2	19.2	19.5	19.7	6.09	19.10c
T6	11.0	11.0	11.0	11.2	11.5	11.7	11.9	7.56	11.33e
T7	19.0	19.1	19.5	19.5	19.7	19.7	20.0	5.00	19.50b
T8	11.0	11.0	11.2	11.2	11.5	11.7	11.8	6.77	11.34e
T9	19.0	19.3	19.5	19.6	20.0	20.2	20.5	7.31	19.73a
Means	14.9f	15.09e	15.45d	15.56cd	15.73bc	15.9ab	16.06a		

Mean values followed by different letters are significantly ($P<0.05$) different from each other.

LSD value for storage interval = 0.1701

LSD value for treatments = 0.2033

Table 3: Effect of storage intervals and treatments on TSS of orange lemonade.

10.5, 19.0, 11.0, 18.5, 11.0, 19.0, 11.0 and 19.0 °brix, which were gradually increased to 12.6, 19.9, 11.7, 19.8, 12.7, 19.7, 11.9, 20.0, 11.8 and 20.5 °brix respectively during 90 days storage. The mean TSS values significantly ($P<0.05$) increased from 14.9 °brix to 16.06 °brix during storage. For treatments maximum mean values were recorded in sample T_9 (19.73) followed by T_1 (19.51) °brix while minimum mean value were observed in T_2 (11.26) followed by T_6 (11.33). During storage maximum increase was observed in sample T_4 (13.3%) followed by T_o (12.6%), while minimum increase was recorded in sample T_3 (4.04%) followed by T_1 (4.52%) (Table 4).

The statistical analysis showed that storage intervals and treatments had a significant ($P<0.05$) effect on TSS of Orange Lemonade drink. These results are in confirmation with the work Zeb et al. [12] who reported that significant increase occur in TSS in grape juice stored at room temperature. These results are in agreement with the findings of Rodrique [18] reported that total soluble solids of mixed orange and carrot juice increased during storage. Gilani [19] also agreed that there was increase in TSS of mango squash prepared from different mango cultivars. Also Kinh et al. [13] reported an increase in TSS of apple pulp preserved with chemical preservative. Shah et al. [20] mentioned that increase in soluble content of the product may be due to the solubilization of fruit constituents during storage.

Overall acceptability

Initially the mean score of judges for overall acceptability of samples (T_0 to T_9) was 8.4, 8.2, 8.1, 8.0, 7.9, 8.1, 8.3, 8.5, 8.0 and 8.0, which were gradually decreased to 1.0, 1.5, 2.0, 2.1, 3.5, 3.0, 4.5, 4.9, 2.9 and 3.0 respectively during 90 days storage. The overall mean scores of judges for overall acceptability significantly ($P<0.05$) decreased from 8.15 to 2.84 during storage. For treatments maximum mean values were recorded in sample T_7 (6.61) followed by T_6 (6.29), while minimum mean score was recorded in T_1 (4.04), followed by T_0 (4.41). During storage maximum decrease was observed in sample T_0 (88.09%) followed by T_1 (81.70%), while minimum decrease was observed in sample T_7 (42.35%) followed by T_6 (45.78%). The statistical analysis showed that storage intervals and treatments had a significant ($p<0.05$) effect on the flavor of carrot and kinnow juice during storage. Rosario [21] observed that increasing storage time and temperature cause progressive degradation, which leads to decrease in overall acceptability. These results in agreement with the findings of Martin [22], who observed the decrease in sensory qualities of pasteurized orange juice bottled in clear glass bottles. The loss of overall acceptability is attributed to the degradation of ascorbic acid and furfural production as described by Shimoda and Osajima

Treatments	Storage intervals (Days)							% Decrease	Means
	Fresh	15	30	45	60	75	90		
T0	8.4	6.5	5.5	4.5	3.0	2.0	1.0	88.09	4.41e
T1	8.2	5.3	4.3	3.5	3.0	2.5	1.5	81.70	4.04e
T2	8.1	7.4	6.4	5.4	3.6	3.6	2.0	75.30	5.21d
T3	8.0	7.6	6.6	5.6	3.5	2.9	2.1	73.75	5.19d
T4	7.9	7.3	6.2	5.2	4.2	3.9	3.5	55.69	5.46cd
T5	8.1	7.1	6.6	5.8	5.1	4.9	3.0	62.96	5.80bc
T6	8.3	7.9	6.5	6.0	5.7	5.1	4.5	45.78	6.29ab
T7	8.5	8.0	7.0	6.5	5.9	5.5	4.9	42.35	6.61a
T8	8.0	6.7	6.2	5.2	4.0	3.1	2.9	63.75	5.16d
T9	8.0	6.9	6.1	5.1	4.2	3.5	3.0	62.5	5.26cd
Means	8.15a	7.07b	6.14c	5.28d	4.22e	3.7f	2.84g		

Mean values followed by different letters are significantly ($P<0.05$) different from each other.

LSD value for storage interval = 0.4803

LSD value for treatments = 0.5741

Table 4: Mean score of judges for overall acceptability of orange lemonade.

[23]. Furfural level accumulated during storage was useful indicator of the overall acceptability in orange juice.

Conclusion and Recommendations

This research work was conducted in order to make a new flavored acceptable drink by mixing two fruit juice i.e. Orange and Lemon; this drink was thus called "Orange Lemonade Drink". To make the shelf life better, different combinations of chemical preservatives in different quantities was used in order to obtain best possible results. The overall result showed that samples T_7 (orange lemonade + sucrose + 0.05 % sodium benzoate + 0.05% potassium metabisulphite) retained maximum nutrients stability and overall acceptability followed by T_6 (orange lemonade unsweetened + 0.05% sodium benzoate + 0.05% potassium metabisulphite during storage at room temperature.

a) It is obvious from the findings of this research work that certainly it can improve the nutritional status of the population and similar research work should be carried out with different preservatives individually as well as with combination.

b) This research work was carried out at ambient temperature, so the research should also be carried out at refrigeration. In this research nutritive sweetener (sucrose) was used to make the acceptable blend of juice for the consumers, so it is also recommended that non-nutritive sweeteners like (saccharin, aspartame etc.) should also be used to carry out the research.

c) High intense light and room temperature may affect Vit. C content, so the research work should also be conducted in plastic, plastic colored bottles and as well as in tin canes in order to check the effect of packaging material on the quality of the juice during storage. Glass bottles were used in this research.

d) Same research work should be done on other fruit juices and squashes like strawberry, lemon and litchi etc. and should also be carried out over a long period of time i.e. 9-12 months.

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