



Biochemical Composition and Shelf Life Study of Mixed Fruit Juice from Orange & Pineapple

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Abstract: In present study, fruit juice has been produced in different ratio of pineapple and orange juice. Juices were pasteurized at 97° C for 5 mins and stored for 35 days in PET bottles at refrigerated temperature. The TSS and pH of the different types of juice were found in the range of 7.73 to 8.53 and 4.33 to 4.53 respectively. Maximum acidity (0.785%) and vitamin C (37.1 mg/100 ml) were found in the sample A (in a ratio 1:1). Aerobic plate count was found within the range of $(92 \times 10^6$ to 233×10^6) cfu/ml. The produced juice blends were subjected to chemical and sensory evaluation at one week interval for five weeks storage time. The chemical analysis showed that, there is a gradual decrease in titratable acidity and Vitamin-C along the storage period. TSS and pH increased progressively during storage period. The mean overall acceptability scores of more than 8 for juice samples indicated the commercial scope for manufacturing good and nutritious pineapple juice blended with orange juice. From all the analysis, it can be observed that the juice blend can be kept conveniently for three weeks without preservatives and 28 days with sodium benzoate at the rate of 0.6 mg/L.

Key words: Juice; Shelf life; Orange; Pineapple

Introduction

In Bangladesh, different kinds of seasonal fruits are available which are rich in food nutrients, vitamins and minerals particularly, some seasonal citrus fruits are very delicious and nutritious. Pineapple (*Ananas comosus*) has long been one of the most popular of the non-citrus tropical and subtropical fruits around the world, largely because of its attractive flavor and refreshing sugar-acid balance and is consumed as fresh fruits, juice and others (Bartolome *et al.*, 1995). Pineapple was reported to contain polyphenolic compounds and also possess antioxidant activity (Hossain and Rahman, 2011). Studies show that compounds such as phenolics and flavonoids are responsible for providing antioxidant activity (Kahkonen *et al.*, 1999; Allothman *et al.*, 2009; Mhatre *et al.*, 2009; Danino *et al.*, 2009). Raw pineapple juice contains almost all vitamins and minerals essential for the digestive system. Pineapple juice contains a mixture of protein-digesting enzymes called Bromelain. Bromelain is an anti-inflammatory agent. Juice extracted from pineapple can be processed into many forms such as concentrated juice, mixed juice and single strength juice. Orange (*Citrus cinensis*) on the other hand, is a distinguished, widely consumed fruit, particularly appreciated for its fresh flavor, vitamin C, and its natural antioxidants source having health benefits. Orange juice is rich in vitamin C, folic acid, potassium and excellent source of bioavailable antioxidant phytochemicals. Fruit juices are important trade commodities in most countries (Vasavada, 2003). Juices are available in their natural concentrations or in processed forms.

Juices are fat-free, nutrient-dense beverages rich in vitamins, minerals and naturally occurring phytonutrients that contribute to good health (Franke *et al.* 2005). Fruit juice blends can be produced from various fruits in order to combine all the basic nutrients present in these different fruits. This usually gives a better quality juice nutritionally and organoleptically. Moreover, one could think of a new product development through blending in the form of a natural health drink, which may also be served as an appetizer. Generally, the shelf life of fresh juice is restricted by enzyme and microorganism activity. Spoilage of fruit juices is mainly due to the presence of osmophilic microflora (Tahiri *et al.*, 2006). This microflora (yeasts) causes fermentation and produce a buttermilk-like off-flavour (Tournas *et al.*, 2006). An effective method of fruit preservation should retain the original characteristics of fruit as convenient as possible. Presently, thermal pasteurisation is considered the most effective technology in inactivating microorganisms and enzymes to extend product shelf life (Noci *et al.*, 2008). The present study was carried out for the development of mixed fruit juice from orange and pineapple in different ratio and establishment of product shelf life and quality evaluation during storage.

Materials & Methods

1.1. Sample collection

The fully ripened and fresh Orange (*Citrus sinensis*) & Pineapple (*Ananas comosus*) were collected from the local market of Sylhet.

1.2. Preparation of juice

The fully ripened and fresh orange and pineapple fruits were washed thoroughly with clean water to remove dirty material, dust, pesticide etc. The collected pineapple and orange were peeled off and cut into pieces and remove the seeds. Then, juice was extracted using multi fruit juice extracting machine.

The juice was filtered using a 500 micro aperture stainless steel sieve screen. The percentage of orange and pineapple juice for the development of four different types of product (A, B, C, D) are given in the table 1. Sodium benzoate was added at a level of 0.6g/1000ml in sample D and mixed thoroughly with sterilized glass rod and spoon.

Table 1: Formulation for mixed fruit juice.

Products	Orange (%)	Pineapple (%)	Sodium benzoate (g/1000ml)
Sample A	50	50	0
Sample B	30	70	0
Sample C	10	90	0
Sample D	50	50	0.6

1.3. Thermal pasteurisation treatment

Thermal pasteurization was performed by heating the mixed juice at 97° C for 5 mins. The temperature of the juice during the heating process was monitored using a thermocouple. The pasteurised juices were filled in sterilized PET bottles and capped with sterilized caps. Then all the samples were cooled and stored at refrigerated temperature ($4 \pm 1^{\circ}$ C) for 35 days.

1.4. Chemical analysis of fruit juice

Total soluble solids (TSS) content of a solution is determined by the index of refraction. This is measured using a refractometer, and is referred to as the degrees Brix. pH was measured by a pH meter. Vitamin C or Ascorbic acid was determined by using the official method of analysis. (AOAC, 1990). The acidity was determined by titration using standard sodium hydroxide solution and expressed as anhydrous citric acid (Ranganna S, 2003).

1.5. Microbiological analysis of fruit juice

For the assessment of microbiological quality of juice, Enumeration of Aerobic Plate Count (APC), total fungal count were performed according to ISO standard method (ISO-4833:2003(E), Microbiology of food and animal feeding stuffs-Horizontal method for the enumeration of microorganisms- Colony-count technique at 30°C). Enumeration of APC was done by serial dilution technique followed by pour plate method and plate count agar was used.

1.6. Sensory analysis

Panel of ten judges was selected from the postgraduate students and teaching staff of the Institute who were supposed to be organoleptically familiar with beverages assessment. Sensory evaluation (color, flavor, taste and overall

acceptability) of preserved orange juice was carried out using a 9 point hedonic scale. The hedonic scale was ranked as; like extremely to very much (8-9 scores), like moderately to like slightly (5-7 scores), neither like nor dislike to dislike slightly-dislike moderately (2-4 scores) and dislike very much to dislike extremely (0-1 score).

1.7.

Statistical analysis

The data obtained were analyzed and interpreted by analysis of variance (ANOVA) and Tukey means comparison test at a level of 5% of significance, using SPSS Version 20.0 software (SPSS Inc., USA). Values were presented as mean \pm standard deviations of 3 observations.

2. Results and Discussion

2.1. Chemical analysis

The juices were analyzed for TSS, pH, Acidity and vitamin-C. TSS of the different types of juice was found in the range of 7.73 to 8.56. Out of four samples maximum TSS was found in the sample D. The p^H of the sample was found in the range of 4.33 to 4.53. Maximum acidity was found in the sample A (50% orange and 50% pineapple juice) which was 0.785% due to higher proportion of orange as orange is more acidic than pineapple. Awsi Jan & Er. Dorcus Masih (2012) reported that the titrable acidity content of pineapple and orange juice with different ratio vary from 0.83 to 0.54, which is similar to our present study. Vitamin-C content (37.1 mg/100 ml) of the sample A was significantly ($P < 0.05$) higher than other samples. So sample A is nutritionally rich than other samples. The proximate composition of mixed fruit juice was more or less similar with the values reported by Awsi Jan & Er. Dorcus Masih (2012).

Table 2: The proximate composition of the prepared juice

Sample	TSS (°Brix)	pH	Acidity (% of citric acid)	Vitamin C
Sample A	8.53±0.35 ^a	4.33±0.05 ^a	0.785±0.011 ^a	37.1±0.95 ^a
Sample B	8.23±0.35 ^b	4.53±0.05 ^b	0.717±0.009 ^b	33.3±1.05 ^b
Sample C	7.73 ±0.30 ^c	4.50±0.00 ^b	0.624±0.008 ^c	30.9±0.53 ^c
Sample D	8.56±0.35 ^d	4.43±0.05 ^{ab}	0.761±0.006 ^d	34.6±0.85 ^b

Values expressed as the mean ± standard deviation. The same letter in the same column indicates no significant difference at the level of 5% significance.

2.2. Microbial analysis

Two parameters were studied viz. Aerobic plate count and Total fungal count for the microbiological quality analysis of juice. The result of APC and Total fungal

count are documented in Table 3. The APC in juice sample was found range from 92 cfu /ml to 233 cfu /ml. Total fungal count was ranged from 19 cfu /ml to 55 cfu/ml.

Table 3: Microbial analysis of the prepared juice

Product	APC (cfu /ml)	Total fungal (cfu /ml)
Sample A	167	43
Sample B	173	55
Sample C	233	49
Sample D	92	19

2.3. Storage studies of mixed fruit juice

The produced juice blends were subjected to chemical and sensory evaluation at one week interval for five weeks storage time. Table 4 shows the effects of storage time on chemical composition and organoleptic quality of orange and pineapple juices. TSS increased with gradual passage of storage time, which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. At first day TSS of the samples were ranged from 7.7 to 8.5, which were gradually increased to 9.8 to 10.3 during 35 days of storage. Similar results were also reported by Deka and Sethi (2001). Bull et al. (2004) also reported that the Brix of thermally processed Valencia and Navel orange juice did not change significantly during storage time at 4°C. pH is one of the important quality characteristics that describes the stability of bioactive compounds in fruit juice (Sanchez-Moreno et al., 2006). There was a significant increase in pH during storage, which affects the organoleptic quality of juice. This might be due to decrease in titrable acidity, as acidity and pH are inversely proportional to each other. It was observed that the maximum pH (5.6) was recorded in the sample D. During storage maximum increase (27.27%) was observed in the sample A and sample D. Similar result was found by Dhaliwal and Hira (2001), where maximum increase

of pH was 29.9%. Cortes *et al.* (2008) similarly found that pH increased significantly in the fresh high-pressurised and pasteurised orange juice during 7 weeks of storage at 2°C and. These researchers stated that the increased pH values in these juices were caused by the microorganisms that caused juice spoilage. Del Caro *et al.* (2004) also found a pH increase in citrus segments and juices stored at 4°C. Titrable acidity was decreased during storage. This might be due to conversion of acids into salts and sugars by enzymes particularly invertase. During storage maximum decrease was observed in the sample B (15.62%) while minimum decrease was observed in the sample D (5.78%). Similar result was found by Tiwari (2000) in guava and papaya blended RTS beverage and Dhaliwal and Hira (2001) in carrot juice blends. Ascorbic acid (vitamin C) is an important nutrient that possesses antioxidant ability and provides the protection against free radicals (Esteve *et al.*, 2005). It is also considered an indicator of the nutritional quality of juices (Bull *et al.*, 2004). Storage temperature, type of processing and packaging materials affect the rate of ascorbic acid degradation during storage (Ayhan *et al.*, 2001). The ascorbic acid content of the juice decreased significantly ($p < 0.05$) during storage with the advancement of storage period, which was probably due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst (Davey *et al.*, 2000). Thermally pasteurised juice retained 50% of their initial ascorbic acid up to 3 Weeks. Juices with 50% retention of their initial Vitamin C are considered as the end of their shelf life (Shaw, 1992). Organoleptic parameters like color, flavor, and taste of the juices were acceptable up to 21 days of storage. All the products except sample D were deteriorated in quality like change in color and

objectionable taste, development of off flavor after 21 days but sample D was good up to 28 days which was

preserved with sodium benzoate.

Table 4: Storage study of mixed fruit juice.

Storage time	Sample Code	TSS	pH	Acidity (% of citric acid)	Vitamin C (mg/100ml)	Color	Flavor	Taste
Day 0	A	8.5	4.3	0.785	37.1	Orange	Fresh	Good
	B	8.2	4.5	0.717	33.3	Orange	Fresh	Good
	C	7.7	4.5	0.624	30.9	Orange	Fresh	Good
	D	8.5	4.4	0.761	34.6	Orange	Fresh	Good
Day 7	A	8.7	4.4	0.754	31.5	Orange	Fresh	Good
	B	8.5	4.7	0.689	27.3	Orange	Fresh	Good
	C	8.2	4.6	0.608	25.1	Orange	Fresh	Good
	D	9.1	4.5	0.751	28.7	Orange	Fresh	Good
Day 14	A	9	4.6	0.737	25.4	Orange	Fresh	Good
	B	8.8	4.9	0.667	22.6	Orange	Fresh	Good
	C	8.9	4.7	0.578	19.8	Orange	Fresh	Good
	D	9.3	4.7	0.744	24.1	Orange	Fresh	Good
Day 21	A	9.4	4.9	0.722	20.7	Orange	Fresh	Good
	B	9.5	5.1	0.648	18.4	Orange	Fresh	Good
	C	9.5	5.1	0.558	15.2	Orange	Fresh	Good
	D	9.7	5	0.732	18.8	Orange	Fresh	Good
Day 28	A	9.6	5.1	0.691	16.3	Orange	Off flavor	Sour
	B	9.8	5.2	0.621	13.2	Light orange	Off flavor	Good
	C	9.7	5.2	0.539	11.4	Light orange	Off flavor	Sour
	D	10.1	5.3	0.724	15.2	Orange	Fresh	Good
Day 35	A	9.8	5.5	0.688	12.6	Light orange	Off flavor	Sour
	B	10.2	5.3	0.605	8.7	Light orange	Off flavor	Sour
	C	9.9	5.4	0.524	6.5	Light orange	Off flavor	Sour
	D	10.3	5.6	0.717	11.8	Light orange	Off flavor	Sour

2.4. Sensory evaluation of the mixed fruit juice

Table 5 shows the mean sensory score of the blended juice during storage. The evaluations were done for color, flavor, taste and overall acceptability. The color changed in week 4 as shown in the Table 4. The color change within the storage period may be due to the microbiological and chemical reactions that might have occurred. Flavor is a combination of various sensations derived from foods. Flavor was constant for the first three weeks and the changes were noticed in the fourth week. On the taste and overall

acceptability, the orange and pineapple juice was well accepted till the third weeks after which it decreases very rapidly. The intention was to incorporate the maximum possible quantity of pineapple juice in the juice mixture with higher sensory scores. It was observed that the highest sensory score was obtained with maximum incorporation of 50% pineapple juice in the juice blend. Therefore, the ingredient compositions having 50% pineapple juice and 50% of orange juice were selected as optimum.

Table 5: Mean sensory score of mixed fruit juice.

	Product Type	Day 0	Day 7	Day 14	Day 21	Day 28	Day 35
Color	A	8.2	7.9	7.5	6.5	4.6	3.2
	B	7.9	7.5	7.2	6.7	4.4	3.5
	C	7.8	7.5	7.4	6.2	4.2	3.8
	D	8	7.8	7.5	6.8	5.4	4.2
Flavor	A	8	7.6	7.6	6.8	3.5	3.3
	B	7.5	7.5	7	6.2	4	3
	C	7.4	7.5	6.8	6.2	3.7	3.2
	D	7.5	7.2	7.2	7	5.5	3.5
Taste	A	8.4	8.5	7.5	6.5	3.6	2.7
	B	8.2	7.9	7.2	6.4	5.4	3.2
	C	7.5	6.9	7	5.8	4.6	3.8
	D	8.2	7.8	7.6	6.5	5.2	3.5
Overall acceptability	A	8.6	8.2	7.6	7	3.8	3.6
	B	8.4	8.1	7.3	6.8	3.3	3
	C	8.2	7.9	7	6.5	3.3	3.3
	D	8.5	8	7.5	6.9	6.6	4.2

Conclusion

The present study indicates that a good quality value added product could be produced from orange and pineapple juice. The product quality was acceptable up to 21 days without any preservatives and 1 month with preservatives (sodium benzoate at the rate of 0.6g/1000ml). So this juice could be stored for 21 days without any preservatives and 1 month with preservatives at refrigerated temperature. As this fruits have some special medicinal and nutritive value, it is assumed that it could fetch a good momentary value from the consumer. On the basis of above results revealed in the present study it may be concluded that the formulation of mixed fruit juice is possible to satisfy consumer taste and preferences. Therefore, the present study is a sign of bright prospect of processing mixed fruit juice.

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