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# Processing of mixed fruit juice from mango, orange and pineapple

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ABSTRACT

The study was conducted to prepare mixed fruit juice by using mango, pineapple and orange juices. Fully ripen raw mango, pineapple and orange were processed into pulp/juice forms which were analyzed for their composition and consequently processed into mixed fruit juices with a combination of different percentage of mango pulp, pineapple and orange juice. Chemical composition, keeping quality, shelf life and consumers' acceptability of the products were investigated. Chemical analysis showed that TSS, acidity were increased slightly whereas vitamin C and pH were decreased gradually during the storage periods. Storage studies were carried out up to one month with an interval of one week and the result showed that all the samples were in good condition after one month, though little bit of faded color was found at the end of storage periods. Sample with 35% mango juice, 40% orange juice and 25% pineapple secured the highest score on sensory evaluation and showed the best consumer acceptance. This research reveals that perishable fruits can be converted to attractive mixed juice and thus increase the shelf-life, which increase value of the product.

**Keywords:** Mixed fruit juice, sensory evaluation, storage

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## 1 Introduction

Fruits have been a part of human diet and food supplement over the years. They are good sources of essential elements which are very important for our body to make body function properly, such as water, vitamins (A, B1, B2, C, D and E), minerals (Ca, Mg, Zn, Fe, K etc.) and organic compounds (Okwu and Emenike, 2006; Dosumu et al., 2009). Fruits are also great sources of antioxidants which are responsible for scavenging free radicals. Because of high perishability, fruits become rotten quickly and preservation is so essential to make them available for a long period of time (Brett et al., 1996). Fruits can be preserved as beverages such as fruit juice (orange, apple, grape juice etc) or alcoholic beverage such as wine, brandy or vinegar. Juices can be prepared by squeezing fresh fruits mechanically or by enzymatic extraction process. Juices are less fatty, nutrient dense beverages rich in vitamins, minerals and naturally oc-

curring phytonutrients that contribute to good health. Fruit juices promote detoxification in the human body (Minich and Bland, 2007).

Mango (*Mangifera indica* L.) is one of the most popular fruits in many countries among millions of peoples in the world. According to Singh (1968), it contains 75 to 82% water, 8.7 to 20% sugar, 0.14 to 0.71% citric acid, 0.38 to 0.63% ash and 8.5 to 50 mg Vit-C per 100 gm of mango. Pineapple (*Ananas comosus* L.), one of the most appreciated tropical fruits around the world, is a rich source of vitamins (A, B and C), calcium, protein, carbohydrate, iron, carotene etc. and is consumed as fresh fruits, juice and other forms. Protein digestion enzyme, bromelin can be found in pineapple (Collins, 1968). A fresh and ripe pineapple can supply about 116.2% of the daily requirement for vitamin C (Shamsudin et al., 2007). Juice extracted from pineapple can be processed into many forms such as concentrated juice, mixed juice and single strength juice. Orange (*Citrus aurantium*) is a member of the family Rutaceae and has antiviral, antibacterial and antifungal properties (Braun and Cohen, 2007). Orange juice is more nutrient dense than many commonly consumed 100 percent fruit juices, such as apple, grape, pineapple and prune (Rampersaud, 2007). It is rich source of Vitamin C, foliate and flavonoids and improves blood lipid profiles in hyper medicines as a stimulant and appetite suppressant.

The mango, pineapple and orange are seasonal in nature and available in large quantity in peak season. But due to inadequate and improper post-harvest handling, processing and preservation facilities of these fruits, every year a substantial quantity is wasted. By taking thus measure the fruits can be utilized. This measure also promotes the development of processing industries in the growing areas of the country. Many people especially children are not interested to eat fresh fruits but if these fruits are processed in the form of juice, these will be ready to consume these products and thus get the nutrient available in the fruits. Mixed fruit juice may attract the attention of the consumers due to their palatability, attractive color, mixed color, mixed flavor and taste. So it may gain satisfactory consumer acceptance.

The present study was undertaken to fulfill the following specific objectives: a) to find out an acceptable formulation of mixed fruit juice using mango, pineapple and orange juice; b) to analyze the proximate composition of mango, pineapple, and orange juices and prepared mixed juice; c) to study the shelf life of the prepared mixed juices.

## 2 Materials and Methods

### 2.1 Materials

Ripe mango, pineapple, orange, sugar etc were collected from the local market. Other ingredients were used from the laboratory stock. The laboratory equipment and apparatus were used for the research work.

### 2.2 Methods

#### 2.2.1 Preparation of mango pulp

Fresh fully ripe sound mangoes were used for extraction of pulp. After washing properly with potable water, the fruits were peeled by using knife. The mangoes were cut into small pieces and then blended in an electric blender. The pulp was then blanched for 5 minutes at 80 °C and then cooled immediately. Then the pulp was stored at -20 °C for future use.

#### 2.2.2 Preparation of orange juice

For preparation of orange juice, fresh and ripe oranges were used and washed firstly. After washing, the oranges were peeled and cores were removed. The peeled oranges were then transferred into juicer to extract the juice. Extracted juice was filtered using muslin cloth. The filtered juice was then blanched at 80 °C for 5 minutes and cooled immediately. Then the juice was stored at a temperature of -20 °C for further use.

#### 2.2.3 Preparation of pineapple juice

Pineapple juice was prepared by following same procedure of orange juice preparation using fresh, fully ripe and sound pineapples.

### 2.3 Formulation and preparation of mixed fruit juice

Table 1 shows the formulation of mixed fruit juice with different combination of mango pulp, orange juice and pineapple juice. The sample $S_1$ contained 35% mango pulp, 40% orange juice and 25% pineapples juice. The sample $S_2$ contained 40% mango pulp, 25% orange juice and 35% pineapples juice and the sample $S_3$ contained 25% mango pulp, 35% orange juice and 40% pineapples juice. All formulations had 12% TSS, 0.3% acidity, 250 ppm sodium benzoate and 76.44% water in the final product. Mixed fruit juices were prepared in according to the method described by Hossain et al. (2016). TSS was maintained by using sugar after calculating the TSS found from mango pulp, orange juice and pineapple juice. All the ingredients were mixed thoroughly and heated at 65 °C for 5 minutes in prior to proper mixing. The heated

mixed juice was then cooled. After cooling the juice was filled into plastic bottles and capped properly

Table 1. Formulation of mixed fruit juice

| Ingredients | Sample | | |
|---|---|---|---|
| | $S_1$ | $S_2$ | $S_3$ |
| Formulation | | | |
| Mango juice (%) | 35 | 40 | 25 |
| Orange juice (%) | 40 | 25 | 35 |
| Pineapple juice (%) | 25 | 35 | 40 |
| Composition | | | |
| TSS (%)* | 12 | 12 | 12 |
| Acidity (%) | 0.3 | 0.3 | 0.3 |
| Sodium benzoate (ppm) | 250 | 250 | 250 |
| Water (%) | 76.44 | 76.44 | 76.44 |

## 2.4 Proximate chemical analysis

The freshly prepared mango pulp, orange juice and pineapple juice and stored mixed fruit juice were analyzed for moisture, ash, titrable acidity, PH, total soluble solid (TSS), and vitamin C. All the determinations were done in triplicate and the results were expressed as the average value. The moisture content was determined in accordance to adopting AOAC (2015) moisture measurement method 2.049, total ash content by using AOAC method 14.0069 (2003), titrable acidity and Vitamin C (ascorbic acid) were determined as per Ranganna (2005), total soluble solids (TSS) by using a hand refractometer (HI 96801, Keison International Ltd., Chelmsford, England), pH by the conventional procedure followed by Islam et al. (2015) using a pH meter (HI98190, Hanna Instruments Inc., Limena, Italy).

## 2.5 Sensory evaluation

Sensory evaluation of all the samples of mixed fruit juice was done by taste testing panel. The panel was made up with 10 test panelists and they were selected from the teachers, students and employees of the department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh and were briefed before evaluating sensory quality of the juices' samples. The panelists were requested to evaluate color, flavor, sweetness, and overall acceptability by scoring rate on a 9 point hedonic scale. The scale was arranged such that: 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely. The results were evaluated by Analysis of Variance (ANOVA) and Fisher's LSD Multiple Comparison Test.

## 2.6 Storage studies

All the mixed fruit juice samples were stored at room temperature and the different assessing parameters were observed at a regular interval of ten days up to one month in glass bottles.

# 3 Results and Discussion

## 3.1 Composition of mango pulp, orange juice and pineapple juice

The prepared mango pulp, orange and pineapple juice were analyzed for moisture, ash, acidity, vitamin C, total soluble solid, and sugar. The results are shown in Table 2. The analysis showed that mango pulp contained 84% moisture, 0.57% ash, 0.17% acidity, 40 mg vitamin C per 100 g and 11% TSS. The result was more or less similar to that reported by Rahman (2003). He found 84.4% moisture, 0.45% ash, 4.3 mg vitamin C per 100 g and 11.6% total sugar. The extracted orange juice contained 87% moisture, 0.33% ash, 4.02% acidity, 30 mg vitamin C per 100 g of sample and 12.2% TSS, which are very close to Klavons et al. (1994). He reported that 88.3% moisture, 6% citric acid, 8.45% sugar and 26.4 mg vitamin C per 100 g. The compositional analysis of pineapple juice showed 78% moisture, 0.62% acidity, 0.48% ash, 7.8 mg vitamin C per 100 g sample and 12% TSS. The results are near to that reported by (Kelebek et al., 2009), who found 75% moisture, 0.38% ash, 0.64% acidity, 8.7 mg vitamin C per 100 g and 13.2% TSS and 9.94% total sugar in orange juice.

Table 2. Composition of mango pulp, orange juice and pineapple juice

| Composition | Mango pulp | Orange juice | Pineapple juice |
|---|---|---|---|
| Moisture (%) | 84 | 87 | 78 |
| Ash (%) | 0.57 | 0.33 | 0.4 |
| Acidity (%) | 0.17 | 4.02 | 0.62 |
| Vit C (mg/100g) | 40 | 30 | 7.8 |
| TSS (%) | 11 | 12.2 | 12 |

## 3.2 Composition of mixed fruit juices prepared by mango pulp, orange juice and pineapple juice

The TSS and acidity of the prepared juices were fixed as 12% and 0.3% respectively and moisture, vitamin C and pH were measured. The obtained results were shown in Table 3. All of the samples gave same pH value of 3.8 while 84% moisture and 13.12 mg vit-C/100g, 88% moisture and 14.20 mg vit-C/100g, and 75% moisture and 14.60 mg vit-C/100 g were found in sample $S_1$, $S_2$ and $S_3$ respectively.

Table 3. Composition of prepared mixed fruit juices

| Component | Sample | | |
|---|---|---|---|
| | $S_1$ | $S_2$ | $S_3$ |
| Moisture (%) | 84 | 88 | 85 |
| Vitamin C (mg/100g) | 13.12 | 14.2 | 14.6 |
| Acidity (%) | 0.3 | 0.3 | 0.3 |
| TSS (%) | 12 | 12 | 12 |
| PH | 3.8 | 3.8 | 3.8 |

## 3.3 Sensory evaluation

The mean scores of sensory evaluation are presented on Table 4. In case of color preference among the sample, ANOVA analysis showed that there was a significant difference in color preference. Sample $S_1$ secure the highest score 7.5 and ranked as like moderately while sample $S_3$ secured the lowest score of 6.0 and ranked as like slightly. In case of flavor preference, sample $S_1$ the most acceptable among three samples. Sample $S_1$ secured the highest score 7.6 with moderately like ranking, followed by sample $S_2$ (score = 6.8) and the lowest score was obtained by sample $S_3$ (score = 5.9) in case of flavor. From Table 4, it has been seen that sample $S_1$ got the highest score of 7.7 and significantly differs from sample $S_3$ but not from sample $S_2$ at 1% level of significance for sweetness. In terms of overall acceptability, sample $S_1$ and $S_2$ were equally acceptable but sample $S_3$ varied significantly from others.
Thus from sensory analysis it is seen that mixed fruit juice containing 35% mango pulp, 40% orange juice and 25% pineapple juice secured the highest score color, flavor, sweetness and overall acceptability.

Table 4. mean score for color, flavor, sweetness and overall acceptability of mixed fruit juices

| Sample | Sensory attributes | | | |
|---|---|---|---|---|
| | Color | Flavor | Sweet-ness | Overall acceptability |
| S1 | 7.5a | 7.6a | 7.7a | 7.9a |
| S2 | 7.1a | 6.8ab | 6.9a | 6.5a |
| S3 | 6.0b | 5.9b | 6.2b | 5.7b |
| LSD† | 1.062 | 1.029 | 0.9591 | 0.882 |

† least significant difference at 1% level of significance.

## 3.4 Storage studies of mixed fruit juice

The formulated mixed juice samples were stored at room temperature and the change of TSS, acidity, pH and Vitamin-C content was observed during the storage period (Table 5).

### 3.4.1 Acidity

Acidity was calculated on the basis of titratable acidity. Titrable acidity is a measure of shelf life of the product and guard against the attack of microorganisms. From the observed acidity, it was found that initial acidity was 0.3% for all three samples. After one month of storage at room temperature the acidity was changed to 0.33%, 0.35% and 0.37% for sample $S_1$, $S_2$ and $S_3$ respectively. Majumdar et al. (2011) reported that acidity increased from 0.25-0.36% during storage of cucumber-basil juice. Hossain and Rahman (2011) found that acidity changed from 0.39% to 0.51% in apple and apricot blend juice during storage.

Table 5. Change of different parameters of formulated juices during storage

| Storage period | Sample | TSS (%) | pH | Acidity (%) | Vit-C (mg /100g) |
|---|---|---|---|---|---|
| 0 d | S1 | 12.00 | 3.80 | 0.30 | 13.12 |
| | S2 | 12.00 | 3.80 | 0.30 | 14.20 |
| | S3 | 12.00 | 3.80 | 0.30 | 14.60 |
| 10 d | S1 | 12.00 | 3.80 | 0.30 | 13.10 |
| | S2 | 12.10 | 3.80 | 0.30 | 14.13 |
| | S3 | 12.20 | 3.80 | 0.30 | 14.54 |
| 20 d | S1 | 12.03 | 3.78 | 0.31 | 12.00 |
| | S2 | 12.15 | 3.77 | 0.33 | 13.06 |
| | S3 | 12.25 | 3.76 | 0.34 | 14.10 |
| 30 d | S1 | 12.10 | 3.76 | 0.33 | 12.16 |
| | S2 | 12.25 | 3.75 | 0.35 | 13.25 |
| | S3 | 12.30 | 3.70 | 0.37 | 13.35 |

Mishra et al. (2012) reported change in acidity in amla-grape juice from 0.40% to 0.49%. The results are more or less similar to those reports. The acidity might be increased due to degradation of carbohydrates present in mixed fruit juice by the action of microorganisms. Increase in tritable acidity during the storage period may be due to activity of some acid producing bacteria such as *Alicyclbacillus acidosterrestris* (Sheikh, 2004).

### 3.4.2 Total Soluble Solids (TSS)

Initially TSS (12%) was same in all three samples, but changed slightly during storage period at room temperature. After one month TSS value increased to 12.1, 12.25 and 12.30% in samples $S_1$, $S_2$ and $S_3$ respectively. It was found that in sample $S_3$, the TSS changed from 12.00 to 12.30%. It might be occurred due to the presence of higher portion of solid content of pineapple. Majumdar et al. (2011) found that during storage of gourd- basil leaves juice, the TSS changed from 11.32 to 11.50. The trend in increasing TSS are well reported. The TSS might be increased due to conversion of complex carbohydrate to simple sugar present in juice. TSS might also be increased

due to inappropriate capping of glass bottles.

#### 3.4.3 pH

pH is inversely proportional to the acidity. pH for all samples at various storage periods was observed and shown in Table 4. After one month of storage at room temperature the pH was changed from 3.80 to 3.76, 3.75 and 3.70 for samples $S_1$, $S_2$ and $S_3$ respectively. Dhaliwal and HIRA (2001) reported that pH of fruit juices decreased (3.9 to 3.6) with corresponding increase in acidity during storage. Mishra et al. (2012) reported that pH values decreased from 4.02 to 3.41 in amla-grape blend juice during storage. High acid and low pH may be due to production of acetic acid and lactic acid during storage. The decrease in pH during storage might be due to degradation of carbohydrates present in mixed fruit juice by the action of microorganisms.

#### 3.4.4 Vitamin C

Vitamin C or ascorbic acid of different formulated mixed fruit juice was determined at various storage periods. The results are shown in Table 4. The initial vitamin C of different samples were 13.12 mg/100g, 14.20/100g, 14.60 mg/100g for samples $S_1$, $S_2$ and $S_3$ respectively. Ascorbic acid changed from 18.38 to 12.90 mg/100ml juice in kinnow-anola-ginger blend juice (Bhardwaj and Mukherjee, 2011). The degradation of ascorbic acid content might be occurred due to the sensitivity of the acid to light, oxygen and moisture content. The loss in ascorbic acid content during storage due to rapid conversion of L-ascorbic acid into dihydro-ascorbic acid in the presence of L-ascorbic acid oxidase enzyme (Bashir and Abu-Goukh, 2003). Concerning the effect of storage temperature on fruit juice, vitamin C content was significantly decreased with increasing storage temperature (Ezz and Awad, 2011).

## 4 Conclusion

The experiment implies the prospect of the processing of mixed fruit juice as well as investigates the nutritional and commercial aspects of mixed fruit juice. Consumer acceptability and storage stability of three samples implies mixed fruit juice can be prepared by using a combination of 35% mango pulp, 40% orange juice and 25% pineapple juice with best consumer acceptability and can be used upto one month without any spoilage. Slight variation of TSS, acidity, pH and vitamin C has been seen but might not affect the eating quality of the products.

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