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Research Article

Production and characterization of mixed fruit juice from papaya, mango, and guava fruit

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Abstract

Mixed fruit juices can provide either nutritional or organoleptic quality properties. It is also one tactic of postharvest loss reduction. This study was conducted to prepare mixed fruit juice from papaya, mango, and guava fruit. Papaya, mango, and guava fruit were processed into juice and analysed their composition. The processed fruit juice was mixed with different percentage of papaya, mango, and guava juice. Finally chemical composition, shelf life and sensory quality of the products were investigated. The total soluble solid, pH and vitamin C content decreases from 12.00-11.67, 3.80-3.67 and 45.21-16.80 with increasing of storage time from 0 to 30 days respectively. Whereas titratable acidity increases from 0.30-0.37 with increasing of storage day 0 to 30 days. According to storage results up to one month mixed fruit juice were in good condition. Among sample 25% papaya, 35% mango juice, and 40% guava juice have been the highest score and best overall acceptance. This research reveals that postharvest loss fruits can be reduced by converting fruit into attractive mixed juice and thus increase the shelf-life, which increase value of the product.

Keywords: Guava fruit, Mango fruit, Papaya fruit, Sensory evaluation, Storage.

Abbreviations : ANOVA (Analysis of variance), pH (Power of hydrogen), TSS (Total soluble solid).

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 (Begum et al., 2018). Fruits are also great sources of antioxidants which are responsible for scavenging free radicals. Currently, fruits are difficult to keep for long and are utilized either as fresh or processed into juice and specialist products due to being susceptible to bacterial and fungal contamination. It is common to experience that 20-50% of the fruit is completely damaged & spoiled before it reaches the consumer (Rahiel et al., 2018). Fruits can be prserved either by procesing into juice, nectar, pulp, jam, jelly, slices and being used as an additive to other fruit juices or pulps (Curti et al., 2013). Fruit such as banana, cucumber, pineapple, mango, guava, apple, and strawberries can also utilized for alcoholic beverage such as wine, and brandy production (Obaedo, 2009; Degner et al., 2014).

Papaya (pawpaw) is a tropical fruit with a unique flavour, aroma and pleasant sour-sweet taste, a good source of vitamin C, and dietary fiber. It is the most important cultivated fruit in Ethiopia in area and production after mango, banana, and citrus (Baskar et al., 2020). Fruits particularly papaya fruits are difficult to keep for long and are utilized either as fresh or processed into juice and specialist products due to being susceptible to bacterial

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and fungal contamination. Adding value through processing is one tactic to reduce thus losses such as papaya fruit. For instance production of fruit juice from papaya is one option. Papaya juice is better for increment of acidity those can increase the acidity and improve the stability of juice (Patil et al., 2021). Papaya juice can enhance the flavour of juice by increasing acidit.

Mango (Mangifera indica L.) is one of the most popular fruits in many countries among millions of peoples in the world. According to Singh, 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.

Guava (Psidium guajava L.) is a tropical fruit with a sweet aroma and pleasant sour-sweet taste. It is the most important cultivated fruit in Ethiopia (Tesfay et al., 2019). Guava is a fruit with pleasant and delicious fruit. The pulp near the centre is the sweetest, the outer layer is acidic and gritty like a young pear, while the rind has a sour taste but is rich in phytochemicals (Profile & Bioactivities, 2021). Guava contains a high concentration of ascorbic acid (Rani & David, 2021).

All thus fruits are seasonal in nature and available in large quantity in peak season. However, due poor postharvest handling practice, processing and preservation facilities of these fruits, a substantial quantity is wasted. This measure also promotes the development of processing industries in the growing areas of the country. Many people especially children interested juice rather than eat fresh fruits. 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 colour, mixed colour, mixed flavor and taste. So it may gain satisfactory consumer acceptance. Therefor the objectives of the current study is processing of mixed fruit juice and analyze the proximate composition of mixed fruit juice.

MATERIALS AND METHODS

Materials

Matured, undamaged, and free from infection (visually detected) raw materials such as papaya, mango and, guava fruit were selected and collected. All necessary other ingredients, laboratory equipment and apparatus were collected in the laboratory room.

Methods

Preparation of papaya pulp

Matured, non-damage papaya fruit was first harvested. The maturity was screened by physical methods such as color and size. Papaya fruit were purchased from Bahir dar market and transport in to the laboratory. The fruit was sorted to remove damaged, infected, and immature papaya fruits. The fruit was washed with clean water to remove unwanted impurity. Papayas were peeled with aid of knife and the pulps were cut into small size then the fruit was squeezed by vertical cutter mixer to produce papaya 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.

Preparation of mango pulp

Fresh 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 with vertical cutter mixer. 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.

Preparation of guava juice

Guava juice was prepared by following same procedure of mango juice preparation using fresh, fully ripe and sound guava fruit.

Formulation and preparation of mixed fruit juice

Table 1, shows the formulation matrix of papaya pulp, mango pulp and guava mixed fruit juice with different proportions. 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 (Begum et al., 2018). The total soluble solid was adjusted by using sugar. 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.

Proximate chemical analysis

The freshly prepared papaya pulp, mango pulp and guava juice and stored mixed fruit juice were analyzed for moisture, ash, titrable acidity, PH, total soluble solid (TSS),

Table 1. Formulation of mixed fruit juice.

Sample	Ingredients					Composition	
	Papaya juice (%)	Mango juice (%)	Guava juce (%)	TSS (%)	Acidity (%)	Sodium benzoate (ppm)	Water (%)
B1	25	35	40	12	0.3	250	76.44
B2	35	40	25	12	0.3	250	76.44
B3	40	25	35	12	0.3	250	76.44

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and vitamin C. All the determinations were done in triplicate and the results were expressed as the average value. The total ash content and moisture content was determined in accordance to adopting AOAC (2015). The pH of both grape wine and sugar cane- red guava fruit blend wine was determined by using a digital pH meter with model PHS-3C (Adedeji & Oluwalana, 2013). Titratable acidity is employed for determining acid content food or drink for sensory description. The titratable acidity determined by titration method (Obaedo, 2009). The sugar content of wine and raw material was determined using a refract meter, RX-5000i-plus and Ascorbic acid was determined by using Spectrophotometry (Desai, 2019).

Sensory evaluation

Sensory evaluation is one of quality determination of mixed fruit juice. All mixed fruit samples was done by panellists. The panellists were selected from Bahir Dar University teachers, students and employees of the department of Food Engineering. The panellists were requested to evaluate colour, flavour, 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.

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.

RESULTS AND DISCUSSION

Composition of papaya pulp, mango pulp and guava juice

The moisture, ash, pH, titratable acidity, vitamin C, and total soluble solid content of papaya, mango and guava fruit juice were analysed. As the results shown in Table 2, papaya pulp contained 82.31% moisture, 0.46% ash, 0.13% acidity, 31.21 mg vitamin C per 100 g, pH 4.51 and 8.67% total soluble solid. The compositional analysis of mango showed juice showed 83.45% moisture, 0.25% acidity, 0.43% ash, 24.11 mg vitamin C per 100 g sample 4.43 pH and 10% TSS. The result was more or less similar to that reported by (Begum et al., 2018). The author found 84% moisture, 0.45% ash, 4.3 mg vitamin C per 100 g and 11.6% total sugar. The extracted orange juice contained 87% moisture, 0.57% ash, 0.17% acidity, 40 mg vitamin C per 100 g of sample and 11% TSS. The compositional analysis of guava juice showed 87% moisture, 0.48% acidity, 0.51% ash, 223.10 mg vitamin C per 100 g sample, 4.25 pH and 11.5% TSS. The guava fruit contains much amount of vitamin C content than other fruit juice. Ascorbic acid is an effective antioxidant, aromatic, and prevents molecular changes caused by oxidation and promoter of iron absorption (Adetuyi & Ibrahim, 2014).

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

The pH, titratable acidity and total soluble solid of the prepared fruit juices were fixed. The result obtained in Table 3, all of the samples gave the same pH value of 3.8, total soluble solid of 12% and titratable acidity of 3.8%. Moisture content, and vitamin C content of blending samples include 86.45% & 45.21 mg/100g, 82.21% & 23.10 mg /100g, and 83.31% % 25.11 mg /100 g were found in sample B1, B2 and B3 respectively (Qasim, 2009).

Sensory evaluation

The scores sensory evaluation shown in Table 4 were subjected to ANOVA. In case of colour preference among the sample, there was no significant difference in color with sample B1 and B3 in mixed fruit juice. Sample B1 has the highest score 7.6 and ranked as like moderately while sample B2 secured the lowest score of 6.0 and ranked as like slightly. In case of flavour preference, sample B3 is the most and highest score among three samples. Sample B3 scored the highest score 7.5 with moderately like ranking. In the cause of overall acceptability, sample B1 has better acceptable but not significantly different from sample B2. Generally, from sensory point of view mixed fruit juice containing 35% mango pulp, 40% guava and 25% papaya juice scord the highest overall acceptability.

Table 2. Properties of papaya, mango and guava fruit juice.

Composition	Fruit juice		
	Papaya	Mango	Guava
Moisture (%)	82.31 ± 0.11c	83.45 ± 0.22b	87.21 ± 0.13a
Ash (%)	0.46 ± 0.03a	0.43 ± 0.40a	0.51 ± 0.43c
Vitamin C (mg/100g)	31.21 ± 0.21b	24.11 ± 0.03c	223.10 ± 0.50a
Acidity (%)	0.13 ± 0.31c	0.25 ± 0.00b	0.48 ± 0.04a
TSS (%)	8.67 ± 0.00c	10.00 ± 0.01b	11.50 ± 0.00a
pH	4.51 ± 0.06a	4.43 ± 0.30b	4.25 ± 0.00c

Mean values not followed with the same letter in a row are significantly different at P< 0.05.

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Table 3. Composition of prepared mixed fruit juices.

Component	Sample		
	B1	B2	B3
Moisture (%)	86.45 ± 0.22a	82.21 ± 0.03b	83.31 ± 0.11b
Vitamin C (mg/100g)	45.21 ± 0.34a	23.10 ± 0.41c	25.11 ± 0.03b

Mean values not followed with the same letter in a row are significantly different at P<0.05.

Table 4. Sensory attributes of mixed fruit juices.

Sample	Sensory attributes			
	Color	Flavor	Sweetness	Overall acceptability
B1	7.6 ± 0.21a	6.6 ± 0.02b	7.2 ± 0.40b	7.7 ± 0.03a
B2	6.0 ± 0.32b	7.3 ± 0.12a	7.8 ± 0.00a	7.5 ± 0.66a
B3	7.2 ± 0.11a	7.5 ± 0.05a	6.8 ± 0.44b	6.9 ± 0.51b

Mean values not followed with the same letter across column are significantly different at P<0.05.

Table 5. Effect of storage period on the properties of mixed fruit juice.

Storage day	Sample	TSS(%)	pH	Acidity(%)	Vit-C(mg/100g)
0	B1	12.00 ± 0.00a	3.80 ± 0.00a	0.30 ± 0.00d	45.21 ± 0.87a
	B2	12.00 ± 0.00a	3.80 ± 0.00a	0.30 ± 0.00d	23.10 ± 0.50c
	B3	12.00 ± 0.00a	3.80 ± 0.00a	0.30 ± 0.00d	25.11 ± 0.06b
10	B1	11.80 ± 0.01b	3.76 ± 0.77b	0.34 ± 0.03c	42.09 ± 0.12ab
	B2	11.81 ± 0.07b	3.79 ± 0.65b	0.32 ± 0.58c	21.32 ± 0.22cd
	B3	11.80 ± 0.08b	3.77 ± 0.30b	0.32 ± 0.22c	24.50 ± 0.04bd
20	B1	11.79 ± 0.33c	3.74 ± 0.88c	0.38 ± 0.88b	38.40 ± 0.77ac
	B2	11.80 ± 0.21c	3.75 ± 0.76c	0.36 ± 0.13b	17.56 ± 0.08ad
	B3	11.81 ± 0.45c	3.75 ± 0.10c	0.34 ± 0.41b	21.70 ± 0.09d
30	B1	11.33 ± 0.90d	3.63 ± 0.45d	0.41 ± 0.52a	34.11 ± 0.55cd
	B2	11.54 ± 0.22d	3.65 ± 0.23d	0.38 ± 0.60a	13.36 ± 0.06abc
	B3	11.67 ± 0.00d	3.67 ± 0.00d	0.37 ± 0.44a	16.80 ± 0.27ac

Mean values not followed with the same letter across column are significantly different at P<0.05.

Storage studies of mixed fruit juice

As shown in Table 5, mixed fruit juice samples were stored at room temperature. There was change of total soluble solid, titratable acidity, pH and Vitamin-C content observed during the storage period.

Total Soluble Solids (TSS)

As shown the result in Table5, initially TSS (12%) was same in all three samples, but changed slightly during storage period at room temperature. After one month TSS value decreased to 11.33, 11.54 and 11.67% in samples B1, B2 and B3 respectively. This may due to the effect of microbial in degradation of sugar during storage period. Storage period significantly affects the total soluble solid content of mixed juice. The TSS valour ranged from 11.33-12.00% within 0-30 storage days. This value nearly similar to mango, orange and pineapple mixed fruit juice investigated by (Begum et al., 2018).

Titratable Acidity

Titratable acidity is employed for determining acid content food or drink for sensory description. Titratable acidity is an important physicochemical property for the final quality of fruit juice. It can measure the shelf life of product and guard against the attack of microorganisms. Initialy the titratable acidity was adjusted to 0.3% for all three samples. After one month of storage at room temperature the acidity was changed to 0.41%, 0.38% and 0.37% for sample B1, B2 and B3 respectively. There was a significant increasing of acid during storage time. (Begum et al., 2018) reported that acidity increased from 0.30-0.37% during storage of mixed fruit juice and 0.3-0.72% in banana, pineapple and passion Fruits after 30 day of storage investigated by (Matabura & Kibazohi, 2021). According to the authors justification 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.

pH

The value of pH is inversely proportional to the acidity. As shown in Table 5, pH of all three samples various with storage periods. The pH was changed from 3.80 to 3.63, 3.65 and 3.67 for samples B1, B2 and B3 respectively after one month of storage room temperature. These may be

due to production of different organic acids during storage period. The decrease in pH during storage might be due to degradation of carbohydrates present in mixed fruit juice by the action of microorganisms. This idea can be supported by (Begum et al., 2018).

Vitamin C

Ascorbic acid is an effective antioxidant, aromatic, and prevents molecular changes caused by oxidation and promoter of iron absorption. The vitamin C content has been significantly affected by blending ratio of different fruit juice. Vitamin C content of different formulated mixed fruit juice was determined at various storage periods. The results are shown in Table 5. Ascorbic acid changed from 45.21-34, 23.10-13.36, and 25.11-16.80 mg/100g for samples B1, B2 and B3 respectively. The degradation of ascorbic acid content might be occurred due to the sensitivity of the acid to light, oxygen and moisture content. These may by the activity of ascorbate oxidase by a microorganism that converts ascorbic acid to dehydroascorbic acid. This is supported by (Adetuyi & Ibrahim 2014). Thus oxidation reaction is due to the presence of metal ions and free radicals.

CONCLUSION

In current study, physicochemical and sensory properties of papaya, mango and guava mixed fruit juices were investigated. The physicochemical properties of vitamin C, Titratable acidity, total soluble solids, and pH changed during one month of storage. The result implies it is possible to increase the shelf life of fruit juice by mixing different type of fruits with acceptable proportions. The results of this study can be used for stakeholders in the food sector. According to sensory acceptability and storage stability of three samples implies mixed fruit juice can be prepared by using a combination of 40% guava juice, 25% papaya juice and 35% mango juice.

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DECLARATION

We declare that this work is original research article and were not published before. It is not under consideration for publication elsewhere in English or in any other language.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding this work.

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