

Development and Storage Studies of Naturally Flavored Papaya-Pineapple Blended Ready-to-Serve (RTS) Beverages

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Abstract: An experiment was conducted to study the feasibility of blending papaya and pineapple juice in combination with different naturally flavored extracts in different ratio for preparation of flavored and blended Ready-to-Serve beverage. The flavored and blended RTS was analyzed for its different physicochemical as well as sensory qualities by adopting 9 point Hedonic scale. Among different blended ratio for prepared RTS, the ratio of 50:50 was reached the highest sensory scores for overall acceptability. Extracts of ginger+ cardamom in the ratio of 1:1 was found to be more suitable as flavoring agents in papaya and pineapple blended RTS beverages.

Keywords: Blended RTS beverage, Papaya, Pineapple, Flavoring agent, Glass bottles

1. Introduction

Fruits and vegetables are important constituents of the diet and provide significant quantities of nutrients, especially vitamins, sugars, minerals and fiber. Daily consumption of fruits and vegetables reduce the risk of cancer, heart disease, premature aging, stress and fatigue primarily due to the integrated action of oxygen radical scavengers such as β -carotene and ascorbic acid plus calcium and dietary fiber. Due to the perishable nature of the fruits and vegetables they require immediate processing to avoid post harvest losses (20-25%). This may be attributed to change in dietary habits, taste preferences and the way of life of present-day consumers. Fruit and vegetable beverages have higher nutritional, medicinal and calorific values compared to synthetic beverages [1]. Moreover, owing to high acidity, astringency, bitterness and such other factors in some of the fruits and vegetables, the utilization of these fruits for the preparation of various processed products becomes limited, despite having high nutritional qualities. Therefore, blending of two or more fruit and vegetable juices for the preparation of ready-to-serve beverage may be a convenient alternative for the utilization of these fruits and vegetables. Spices beverages are gaining importance in the market in the form of fruit drink/squashes/appetizers/health drinks etc. It has been reported that the organoleptic quality of RTS beverage prepared from juice could be increased by the addition of spice extracts of ginger, black pepper, mint, cardamom and cumin etc. These spices apart from their appetizing properties also possess medicinal and therapeutic values, which have a profound effect on human health, since they affect many functional processes.

Papaya fruits (*Carica papaya*) are available throughout the year in India. The fruits are rich in nutrients especially carotene, which is converted into vitamin A in the human body. Vitamin A prevents blindness in children. Moreover papaya has many medicinal properties which cure a number of diseases [2]. Pineapple (*Ananascomusus*) is second most popular tropical fruit and cheaply available in market. Its

pulp is juicy and fleshy with the stem serving as supporting fibrous core. It is an excellent source of antioxidant, vitamin C which is required for the collagen synthesis in the body. It contains micronutrients and it protects against cancer and this micro-nutrient break up blood clots is beneficial to the heart [3].

Papaya is blended with other fruits, because of its typical flavor of papaya juice after processing is not liked by few consumers. Some fruits which are rich in nutrients but are not accepted due to high acidity or poor taste and flavour. It can be blended with other fruits to improve their acceptability and make use of available nutrients. Therefore keeping in view of the nutritional and functional attributes of papaya and pineapple, the study was under taken to develop papaya and pineapple RTS beverages in combination with natural spices as flavorants with desirable characteristics.

2. Materials and methods

2.1 Preparation of papaya juice

The freshly ripe papaya fruits were collected and washed thoroughly in running tap water. Fruits were peeled with the help of stainless steel knife, cut into two half and seeds were removed manually. The pulp was grind in laboratory scale mixer grinder and used for processing.

2.2 Preparation of pineapple juice

Ripe pineapples were selected, the crown and stem portion were removed and the fruit was washed in tap water. The pineapples were peeled with knives, eyes were removed and sliced. The prepared slices were crushed in a mixer and the juice was recovered by pressing the crushed mass in a hydraulic press. The juice was filtered through muslin cloth.

2.3 Preparation of flavoring extracts

The flavoring agents in the combination of ginger + cardamom, ginger + lime, mint + lime, mint + ginger, mint + cardamom are used in papaya and pineapple blended RTS beverage. Fifty gram of fresh flavoring agent was mixed in 500ml of water, boiled for 20 minutes in a closed vessel and cooled. The extract of the flavouring agent was filtered and added in the ratio of 1:1 to the RTS beverage in varying proportions (2,4 and 6ml).

2.4 Preparation of flavored papaya-pineapple blended RTS beverages

Flavored and blended RTS beverage was prepared using 15% of total soluble solids (TSS) and 0.3% of acidity and 10% of blended juices of different blending ratio of (A) 70% papaya juice + 30% pineapple juice, (B) 60% papaya juice + 40 % pineapple juice, (C) 50% papaya juice + 50 % pineapple juice and (D) 80% papaya juice + 20% pineapple juice. In the best blending ratio of papaya and pine apple RTS beverage the extracts of flavoring agent was added in varying proportions. Best blended and flavored RTS beverage was selected by organoleptic test which was conducted on 9 point Hedonic scale for appearance, colour, taste, flavour and overall acceptability by a panel of 25 semi trained judges having prior experience of sensory evaluation of fruits and vegetable product.

2.5 Storage studies

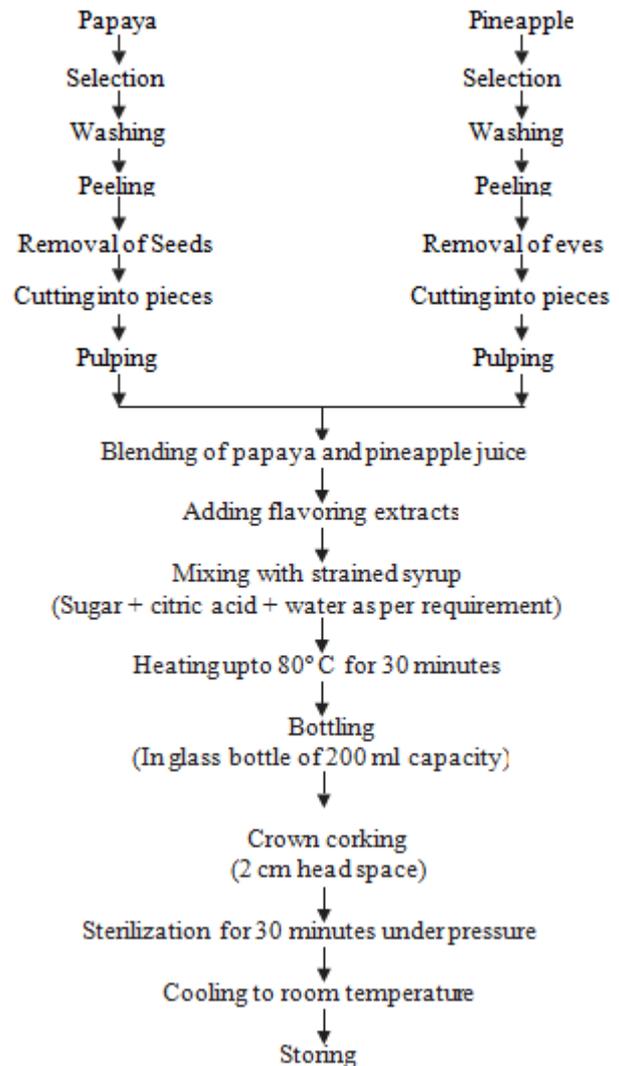
The flavored and blended RTS beverage with best blending ratio (on the basis of sensorial evaluation) was packed in glass bottles and kept at room temperature and changes were determined during at once in twenty days up to four months. TSS, pH, acidity, reducing sugar, total sugar, ascorbic acid and β -carotene was measured by standard method and overall acceptability was measured on 9 point Hedonic scale by 25 semi-trained panel members.

2.6 Statistical analysis

The data obtained were subjected to statistical analysis to find out the impact of packaging material and storage periods on the quality of flavored papaya and pineapple blended RTS beverage. Completely randomized designs were applied for the analysis [4].

2.7 Microbial examination of the products

The sample was serially diluted. Dilution of 10^{-5} and 10^{-6} was taken for all the analysis. One ml of the serially diluted sample was taken in petridishes and appropriate media was added for the specific organism. The plates were incubated at room temperature for 24 hours for bacteria; 72 hours for fungi and the colonies were counted [5].



3. Results and Discussion

3.1 Standardization of papaya-pineapple RTS beverage

The papaya and pineapple fruit pulps were blended in various ratios 80:20, 70:30, 60:40, 50:50 and. Mean scores obtained for the various proportions are given in Table.1

Table 1: Mean sensory scores obtained for the papaya-pineapple RTS beverages

Characteristics	Various proportions of papaya-pineapple RTS beverage			
	80:20	70:30	60:40	50:50
Colour	9.0	9.0	9.0	9.0
Appearance	9.0	9.0	9.0	9.0
Flavor	6.0	6.0	7.0	9.0
Taste	7.0	7.0	7.0	9.0
Overall acceptability	6.0	6.0	7.0	9.0

The colour and appearance of the papaya –pineapple blended RTS beverages were good as is evident from the mean scores obtained for these attributes. When 50:50 proportions was used for blending papaya-pineapple improved all the sensory quality attributes which also reflected in the mean scores obtained during sensory evaluation. Papaya fruits are rich in nutrients but are not accepted due to high acidity or poor taste and flavor. [6] reported that the blending of 30% papaya pulp with 70% guava improve the nutritional as well

as sensory qualities of the RTS beverage, which was found acceptable up to six months at room temperature (20-30°C).

3.3 Standardization of flavoring extracts in the papaya-pineapple RTS beverage

Single and combination of flavor extracts were added to papaya-pineapple blended RTS beverage in various quantities and evaluated the organoleptic characteristics by a panel of judges. Mean scores obtained for the papaya-pineapple blended RTS beverage are given in Table 2.

Table 2: Mean scores obtained for the flavoring extracts in the papaya-pineapple RTS beverage

Blended flavoring extracts used in 200 ml of papaya-pineapple blended RTS beverage	Mean scores obtained for the various sensory parameter				
	Colour	Appearance	Flavor	Taste	Overall acceptability
Ginger + cardamom(1:1)2 ml	9.0	9.0	9.0	9.0	9.0
4ml	9.0	8.0	7.0	7.0	7.0
6 ml	8.0	7.0	7.0	6.0	7.0
Ginger + lime (1:1)	9.0	8.0	8.0	7.0	7.0
4 ml	9.0	9.0	8.0	8.0	8.0
6 ml	9.0	8.0	7.0	6.0	7.0
Mint + lime(1:1)	7.0	8.0	8.0	7.0	8.0
4 ml	7.0	7.0	8.0	6.0	7.0
6 ml	7.0	7.0	8.0	6.0	7.0
Mint + ginger(1:1)	7.0	8.0	8.0	7.0	8.0
4 ml	7.0	7.0	7.0	7.0	8.0
6 ml	7.0	7.0	7.0	6.0	7.0
Mint + cardamom(1:1)	7.0	8.0	8.0	7.0	8.0
4 ml	7.0	9.0	9.0	6.0	9.0
6 ml	7.0	8.0	7.0	6.0	7.0

The combination of the ginger + cardamom flavoring extracts in the papaya – pineapple blended RTS beverage was well accepted by the judges, because of colour, flavor and taste were very good. In the combination of ginger + lime, the colour, appearance and flavor and colour were good but the taste was not acceptable by the judges. Because it imparted slight bitter taste. Whereas the flavor and taste of mint + lime, mint + ginger and mint + cardamom flavoring extracts were acceptable but the colour was not good because of the combination of unpleasant colour of mint extract. Thus it was concluded that blends of extracts of ginger (2ml) + cardamom (2ml) was found to be more suitable in the preparation of papaya-pineapple blended RTS beverage. It has been reported that the organoleptic quality of RTS beverages prepared from juice such as plum and watermelon could be increased by the addition of spice extracts of ginger, black pepper, mint, cardamom and cumin [7] [8]. Similarly, [9] reported that the flavor and organoleptic quality of sugarcane juice was improved by blending with 0.3% lemon juice and 0.1% ginger juice. These spices, apart from their appetizing properties also possess medicinal and therapeutic values, which have a profound effect on human health, since they affect many functional processes.

3.4 Chemical properties of flavored papaya-pineapple blended RTS beverage during storage

The data obtained on chemical properties such as pH, TSS

acidity, reducing sugar, total sugar, vitamin C and β-carotene in flavored papaya-pineapple blended RTS beverage was analyzed once in twenty days up to four months and for the discussions the initial, 60th day and final values were taken. Table 3 shows that the storage period had statistically significant effect on the flavored papaya-pineapple blended RTS beverage.

3.4.1 pH

There was fall in pH value from 3.79 to 3.50 in flavored papaya-pineapple blended RTS beverage. A slight decrease in pH was observed in ready-to-serve bael-guava blended beverage during 60 days of storage [10].

3.4.2. Acidity(%)

A gradual increase in acidity of the flavored papaya-pineapple blended RTS beverage was observed during storage. The initial acidity of 0.31 per cent increased to 0.54 per cent at the end of the storage. Similar results were obtained by [11] in blended pineapple – watermelon ready – to drink juice.

3.4.3 Total soluble solids

The initial TSS content of flavored papaya-pineapple blended RTS beverage was 15.0° Brix which was increased to 18.0° Brix at 120 days of storage. Retention or minimum increase in total soluble solids content of juice during storage is desirable for the preservation of good juice quality. The total soluble solids content in the juice increased apparently during storage, which might be due to hydrolysis of polysaccharides and increase in concentration of juice due to dehydration. [12] found an increasing trend in total soluble solids (12.0 °bx to 14.4 °bx) during storage at low temperature in therapeutic ready-to-serve made from blend of Aloe vera, aonla and ginger juice.

3.4.4 Reducing sugar (g/100g)

As seen from the Table 3 initially the reducing sugar content was 4.26g/100g which increased to 12.72 g/100g in flavored papaya-pineapple blended RTS beverages. The increase in reducing sugar content during storage of the RTS beverage prepared from guava-papaya (70:30) blends was reported by [13].

3.4.5 Total sugars (g/100g)

It was noted that the total sugar content of the flavored papaya-pineapple blended RTS beverage had increased from the initial value of 12.50g/100g to 12.72 g/100g at end of the storage period. The increase in total sugars might be due to the hydrolysis of polysaccharides like pectin, cellulose, starch etc. and its conversion into simple sugars (glucose and fructose). There was a continuous increase in the values of reducing sugars (4.8 to 11.5%) and total sugars (11.2 to 13.6%) in the RTS beverage prepared from pineapple-guava blends during three months of storage [14].

3.4.6 Ascorbic acid (mg/100g)

The ascorbic content reduced from an initial value of 9.12 mg/100g to 7.90 mg/100g in flavored papaya-pineapple blended RTS beverage during storage. Ascorbic acid is an important nutrient, which is not only a natural antioxidant but has a medicinal value as well. Ascorbic acid is sensitive to heat and is oxidized quickly in the presence of oxygen

[15]. Hence, it might have been destroyed during processing and subsequently during the storage period due to its oxidation. [16] reported that the significant decrease in ascorbic acid content from 1.43 to 1.20 mg/100g was also observed in whey based pineapple and bottle gourd mixed herbal beverage.

3.4.7 β -carotene ($\mu\text{g}/100\text{g}$)

The carotene content of the flavored papaya-pineapple blended RTS beverage recorded a steady decrease from an initial value of 450 $\mu\text{g}/100\text{g}$ to 420 $\mu\text{g}/100\text{g}$. The total carotenoids content decreased significantly in all the beverages due to oxidative breakdown, isomerization or enzymatic destruction of the pigments. However, the rate of decline was lower in lime based beverages as they reported to contain, a very stable compound [17]. [18] observed decrease in the carotenoids content of papaya-bael juice blend around 11-55% after six months of storage.

Table 3: Changes of nutrient content in flavored papaya-pineapple blended RTS beverage during storage

Nutrients	Storage days			SED	CD 0.05
	0 day	60 days	120 days		
pH	3.70	3.82	3.95	0.0071	0.0225**
Acidity (%)	0.48	0.32	0.1	0.0100	0.0318**
TSS ($^{\circ}$ brix)	15.0	16.5	18.0	0.0122	0.0390**
Reducing sugar (g/100g)	4.26	4.38	4.52	0.0058	0.0184**
Total sugar (g/100g)	12.50	12.63	12.72	0.0141	0.0450**
Ascorbic acid (mg/100g)	9.12	8.51	7.90	0.0066	0.0132**
β -carotene ($\mu\text{g}/100\text{g}$)	450	438	420	0.0042	0.0084**

3.5 Enumeration of microbial load in flavored papaya-pineapple blended RTS beverage during storage

Initially there was no bacterial count in flavored papaya-pineapple blended RTS beverage during storage. It had increased to 3.00×10^{-6} after 120 days of storage. There was no fungal population was observed in flavored papaya-pineapple blended RTS beverage. Minimum increase in the microbial population was recorded when juice was blended with spices like ginger, mint and black pepper. This might be due to the inhibitory effect of spices towards microorganisms. [19] reported that no bacterial growth was observed in the spice mixed fruit juice RTS beverages. However, there was negligible growth of mold and yeast in the drinks. Spiced extract and juice has been used for prolonging the keeping quality of juice and reducing their spoilage. The possible reason may be that spiced extracts have antibacterial properties which check the oxidation of juice constituents and growth of microorganisms.

3.6 Organoleptic characteristics of flavored papaya-pineapple blended RTS beverage during storage

Table 4 shows the mean score for all the quality attributes was initially 9.00 for flavoured papaya-pineapple blended RTS beverage. Slight changes were observed in all the after 120 days of storage. [12] prepared therapeutic RTS made from blend of Aloe vera, aonla and ginger juice. During storage it was observed that overall sensorial quality of blended therapeutic RTS slightly decreased during storage of 4 months.

Table 4: Organoleptic characteristics of flavored papaya-pineapple blended RTS beverage during storage

Storage days	Sensory attributes				
	Colour	Appearance	Flavor	Taste	Overall acceptability
0 day	9.0	9.0	9.0	9.0	9.0
60 th day	8.7	8.8	8.4	8.2	8.5
120 th day	8.5	8.6	8.2	8.0	8.5

4. Conclusion

On the basis of the above results, it is possible to prepare the fruit RTS beverages by blending various pulpy fruits like pineapple and papaya. It is also indicated that the blended papaya-pineapple RTS beverages with addition of spice extracts was highly acceptable. It can be stored at ambient condition in sterilized bottles for 120 days without showing any symptoms of microbial spoilage. Hence it is finally concluded that when compared to soft drinks, flavored papaya-pineapple blended RTS beverage provide nutrients like ascorbic acid and β -carotene which are also antioxidant essential to maintain health.

5. Future Scope of study

A variety fruit product can be developed by blending less exploited fruits with other fruits to improve the utilization of less exploited fruits. Single and blended spice extracts may be used in fruit drinks to bring variety to common fruit product. There is a great potential for utilization and commercialization of flavored and blended RTS beverage as a natural health drink from major and underexploited fruits not only in the domestic market but also at the export front.

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