Changes in chemical constituents and overall acceptability of guava-papaya jam during storage

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Abstract

Jam prepared from guava-papaya blends was analyzed for changes in chemical constituents and overall acceptability at monthly interval for three months storage period. Total sugars, reducing sugars and browning increased, while ascorbic acid, total carotenoids and total phenols decreased significantly in jam during storage. Jam prepared with 40 guava:60 papaya pulp ratio was most acceptable. The overall acceptability of jam decreased significantly during three months storage.

Keywords: Guava, papaya, blends, jam, chemical constituents, overall acceptability, storage

Introduction

Fruits and vegetables are important constituents of our diet and provide significant quantity of nutrients especially, vitamins, minerals, fibre and sugars. Daily consumption of fruits and vegetables reduces the risk of cancer, heart disease, premature aging, stress and fatigue, primarily due to integrated action of oxygen radical scavengers such as β-carotene and ascorbic acid.

Guavas (Psidium guajava L.) are popularly known as “poor man’s apple” and are rich in dietary fibre and vitamin C (150 to 250 mg/100 g), with moderate levels of folic acid. Ginat et al. (2013) [6] reported that fresh guava juice contains TSS (8.70°Bx), reducing sugars (2.68%), non-reducing sugar (4.78%), total sugars (7.84%), pH (4.21) and titratable acidity (0.44%). The fruit contains carbohydrates (14.5%), protein (1.5%), fat (0.2%), vitamin B1 (30 mg/100 g), vitamin B2 (30 mg/100 g), iron (1.00%), phosphorus (0.04%) and calcium (0.01%). Having a generally broad, low calorie profile of essential nutrients, a single fruit contains about four times more the amount of vitamin C than in orange. It also possesses anticancer properties.

Papaya (Carica papaya L.) belongs to family Caricaceae. It is a common man’s fruit due to its reasonable price and high nutritive value. It is also regarded as “the wonder fruit of the tropics and subtropics”. It is an excellent source of vitamin A (2020 IU/100 g) and also a rich source of other vitamins (Addai et al., 2013) [1]. It has anti-inflammatory, anti-tumour, anti-fungal, anti-bacterial and wound healing medicinal properties (Aravind et al., 2013) [3].

Traditionally, papaya fruit has been used in preparation of salads, juice, ready-to-serve drink, nectar, squash, sherbets, jam and confections like tutti-frutti and candy slices. However, consumers’ trend towards papaya products emphasizes the need of its value enhancement with fortification of novel ingredients and promote it as a high valued product.

Blending of papaya pulp with guava pulp can supplement its blended products with vitamins (especially vitamin A), minerals, besides improving its colour and appearance, taste, flavour and overall acceptability. Keeping the above facts in view, the present research work was planned to standardize appropriate combination of guava-papaya blends for preparation of jam and to evaluate the storage quality of the blended product.

Materials and Methods

The present investigation was carried out in Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar during 2018-19. Ripe guava fruits cv. Hisar Safeda were procured from Experimental Orchard of Deptt. of Horticulture, CCS HAU, Hisar and ripe papaya fruits were procured from local market, Hisar for collecting pulp for making jam from guava-papaya blends (Fig. 1 and 2).
Ripe guava fruits
↓
Washing
↓
Cutting thin slices
↓
Mixing 40% water
↓
Heating at 90°C
↓
Grinding
↓
Sieving
↓
Mixing sodium benzoate (1 g/kg pulp)
↓
Packing in polypropylene jars
↓
Storing in deep freezer

Fig 1: Flow sheet for collection of pulp from guava fruits

Papaya fruit
↓
Washing in clean running water
↓
Peeling off and cutting in halves
↓
Slicing
↓
Blending slices in a mixer
↓
Mixing sodium benzoate (1 g/kg pulp)
↓
Packing in polypropylene jars
↓
Storing in deep freezer

Fig 2: Flow sheet for collection of pulp from papaya fruits

Guava-Papaya jam was prepared from guava-papaya blends (100:0, 80:20, 60:40, 40:60, 20:80 and 0:100) as per standard procedure (Fig. 3). One kg blended pulp, 650 to 700 g sugar, 4.0 to 5.0 g citric acid and 1.0 to 2.0 g pectin were used for preparation of guava-papaya jam. The mixture of pulp, sugar and citric acid was cooked with a ladle with constant stirring to obtain desired consistency. Pectin dissolved in lukewarm water was then mixed with the cooking mass. The end point was judged by sheet test and total soluble solids (68%) were measured using hand refractometer (58-92%). The product was packed in 150 g capacity sterilized glass bottles and stored at room temperature for analyzing its sensory quality. Based on sensory evaluation of all the blended products, guava-papaya jam (100:0, 40:60, 0:100) were selected for further analysis for changes in chemical constituents and overall acceptability at monthly interval during three months storage period.

Guava-Papaya blends
↓
Mixing sugar
↓
Cooking with occasional stirring
↓
Mixing citric acid
↓
Cooking until 60% TSS
↓
Mixing pectin dissolved in lukewarm water
↓
Cooking until end point (68% TSS)
↓
Filling hot in glass bottles (150 g capacity)
↓
Sealing with cap
↓
Cooling in air
↓
Labeling
↓
Storing at room temperature (at 21-35°C)

Fig 3: Flow sheet for preparation of guava-papaya jam

Total sugars and reducing sugars were estimated by the method of Hulme & Narain (1931) \(^7\). Ascorbic acid was determined by method of Ranganna (2014) \(^11\). Total carotenoids were analyzed by Rodriguez-Amaya method (1999) \(^12\). Total phenols were analysed by Amorim \textit{et al.} (1997) \(^2\) and browning was estimated by method of Ranganna (2014) \(^11\). The overall acceptability of guava-papaya jam was based on mean scores obtained for all the sensory characters \textit{i.e.}, colour and appearance, flavour, taste and mouthfeel. The characters with mean scores of 6 and above out of 9 were considered acceptable (Ranganna, 2014) \(^11\). The treatments were replicated thrice and the data were analyzed statistically using completely randomized design. The critical difference value at 5 per cent level was used for making comparison among different treatments during storage.

\textbf{Results and Discussion}

There was a gradual and significant increase in total and reducing sugars of guava-papaya jam with the advancement in storage period. The increase in level of sugars might be attributed to hydrolysis of polysaccharides into sugars and inversion of sugars. The results are in conformity with those of Brandao \textit{et al.} (2018) \(^5\) in mixed cerrado fruit jam and...
Rahman et al. (2018) [10] in guava jam. The ascorbic acid content decreased significantly in guava-papaya jam during storage. It was probably due to the fact that ascorbic acid was sensitive to oxygen, light, enzymatic and non-enzymatic catalyst heat. The differences in chemical composition of raw materials in the recipes might be responsible for these changes. These findings are in conformity with those of Singh et al. (2014) in whey guava beverage and Rahman et al. (2018) [10] in guava jam. A significant decrease in total carotenoids of guava-papaya jam was observed during storage. This might be due to auto-oxidation of β-carotene leading to loss of total carotenoids and also due to its highly unsaturated chemical structure, which made the constituent very susceptible to thermal degradation and oxidation. The results are in accordance with those of Arshad et al. (2018) [4] in protein fortified jackfruit jam. There was also significant decrease in total phenols of guava-papaya jam during storage. Total phenols are easily volatile and oxidized, hence, its content decreased in the samples regardless of exposure to light or darkness. Moreover, cell structure disrupted during processing and the materials became more prone to non-enzymatic oxidation, which could be one of the major causes for loss in total phenols of the products. Similar decrease in total phenols was also reported by Lafarga et al. (2018) [8] in blueberry jam. There was significant increase in browning of guava-papaya jam during storage. This was due to condensation of tannins into brown pigments and inversion of non-reducing to reducing sugars, which participated in the Maillard browning. This might also be due to action of acidity, which enhanced hydrolytic reaction causing browning. Polyphenolic compounds present in fruit pulp also reacts with the enzymes to get discoloration. Similar increase in browning was also reported by Paravisini et al. (2018) [9] in apple juice. Jam prepared with 40 guava:60 papaya pulp ratio was most acceptable and the overall acceptability of guava-papaya jam decreased significantly during three months storage period. Similar results were reported by Ullah et al. (2018) [13] in carrot and apple blended jam.

<table>
<thead>
<tr>
<th>Treatmentsa (G:P)</th>
<th>Storage period (months)</th>
<th>Total sugars (%)</th>
<th>Reducing sugars (%)</th>
<th>Ascorbic acid (mg/100 g)</th>
<th>Total carotenoids (mg/100 g)</th>
<th>Total phenols (mg/100 g)</th>
<th>Browning (440nm)</th>
<th>Overall acceptability (9 point hedonic scale)</th>
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*Recipe- One kg blended pulp, 650 to 700 g sugar, 4.0 to 5.0 g citric acid and 1.0 to 2.0 g pectin

G:P- Guava:Papaya, NS-Non-significant

References

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