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Development and evaluation of guava-papaya jam

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Abstract
Guava-Papaya jam was developed and evaluated for changes in its physico-chemical, microbiological and sensory parameters at monthly interval for three months storage period. Total soluble solids increased significantly, while acidity decreased significantly in guava-papaya jam with the advancement in storage period. Yeast and mold count increased significantly in blended jam during storage. The colour and appearance, flavour, taste, mouthfeel and overall acceptability of guava-papaya jam decreased significantly during storage, however, the products were found acceptable even after three months storage. Jam prepared with 40 guava: 60 papaya pulp ratio was found to be the most acceptable.

Keywords: Guava, papaya, blends, jam, physico-chemical, sensory, parameter, 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.

Guava (*Psidium guajava* L.) is popularly known as "poor man's apple" and is rich in dietary fibre and vitamin C (150 to 250 mg/100 g), with moderate levels of folic acid. It is a good source of other vitamins like A, B and some minerals like Fe, Ca and P. Ginat *et al.* (2013) [4] 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 B_1 (30 mg/100 g), vitamin B_2 (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 guava fruit contains about four times more the amount of vitamin C as in an orange. The high ascorbic acid content of guava makes it a powerhouse in reducing free radicals and oxidation, responsible for causing degenerative diseases.

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) [2]. Traditionally, papaya fruit has been used in preparation of salads, juice, ready-to-serve drinks, 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 promotes 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 sensory attributes. Keeping the above aspects 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 CFST, CCSHAU, Hisar during 2018-19. Ripe guava fruits cv. Hisar Safeda were procured from Experimental Orchard of Department of

Horticulture, CCSHAU, Hisar and ripe papaya fruits were procured from local market, Hisar for collecting pulp from guava and papaya fruits to prepare guava-papaya jam (Fig. 1 and Fig. 2).

Ripe guava fruits
↓
Washing
↓
Cutting thin slices
↓
Mixing 40% water
↓
Boiling to soften slices
↓
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
↓
Peeling off and cutting in halves
↓
Slicing
(after removing seeds and white portion)
↓
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 blended pulp, sugar and citric acid was cooked with constant stirring to obtain desired consistency. Pectin dissolved in lukewarm water was 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 sensory evaluation. Based on sensory evaluation of all the blended products, guava-papaya jam (100:0, 40:60 and 0:100) were selected for analyzing changes in physico-chemical, microbiological and sensory parameters for three months at monthly interval.

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
↓
Labelling
↓
Storing at room temperature (21-35 ^{o}C)

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

Total soluble solids (TSS) were estimated at ambient temperature by hand refractometer (58-92%) for guava-papaya jam. Acidity was determined according to method described by Ranganna (2014) [8]. Serial dilution technique and pour plate method were utilised to enumerate the microbial load *i.e.*, yeast and mold count (log_{10} cfu/g). The colonies were counted after incubation period.

The overall acceptability of guava-papaya jam was based on mean scores obtained for all the sensory characters *i.e.*, colour and appearance, flavour, taste and mouth feel. The characters with mean scores of 6 and above out of 9 were considered acceptable (Ranganna, 2014) [8]. The treatments were replicated thrice and the data were analyzed statistically using completely randomized design. The critical difference value at 5% level was used for making comparison among different treatments during storage.

Results and Discussion

The perusal of data presented in Table 1 show an increasing trend in total soluble solids of guava-papaya jam during three months storage. The increase in total soluble solids might be due to acid hydrolysis of insoluble polysaccharides, especially gums and pectin, and its conversion into soluble sugars. The results are in accordance with the observations of Safdar *et al.* (2014) in guava leather and Ullah *et al.* (2018) [10] in carrot and apple blended jam.

Acidity decreased significantly in guava-papaya jam during three months storage. The decrease in acidity might be attributed to hydrolysis of polysaccharides and non-reducing sugar, where acid is utilized for converting them to hexose sugars (reducing sugars) or complexing in the presence of metal ions. Similar observations were reported by Wani *et al.* (2013) [11] in karonda jam and Sharma (2014) [9] in jamun-mango blended jam.

There was significant increase in yeast and mold count of guava-papaya jam during storage. This could be explained due to the differences in physico-chemical composition among various treatments and changes in the physico-chemical composition of the products during storage. The results are similar to those of Okudu and Obong (2015) [6] in juice and jam developed from two varieties of monkey kola and Bhople *et al*. (2016) [3] in beetroot jam.

There was a significant decrease in colour and appearance, flavour, taste, mouthfeel and overall acceptability of guava-papaya jam during three months storage period. This might be due to changes in chemical constituents or certain enzymatic and non-enzymatic changes in the products. However, organoleptic score of the product remained above the acceptable level even at three months storage. The decrease in sensory scores during storage was also observed by Kanwal *et al*. (2016) [5] in guava jam and Ullah *et al.* (2018) [10] in carrot and apple blended jam.

Table 1: Effect of storage on physico-chemical, microbiological and sensory parameters of guava-papaya jam

Treatments* Guava:Papaya	Storage period (months)	Total soluble solids (%)	Acidity (%)	Yeast and mold count (log_{10} cfu/g)	Colour and appearance (score out of 9)	Flavour (score out of 9)	Taste (score out of 9)	Mouthfeel (score out of 9)	Overall acceptability (score out of 9)
100:0	0	68.00	0.85	-	7.50	7.80	7.80	7.60	7.68
	1	68.26	0.83	-	7.30	7.65	7.65	7.30	7.39
	2	68.57	0.80	2.47	7.20	7.50	7.50	7.15	7.26
	3	68.98	0.78	2.84	7.10	7.20	7.20	7.00	7.10
40:60	0	68.00	0.77	-	8.50	8.55	8.60	8.60	8.56
	1	68.32	0.75	-	8.30	8.40	8.50	8.40	8.40
	2	68.76	0.72	2.17	8.20	8.30	8.30	8.20	8.25
	3	69.03	0.70	2.65	8.00	8.15	8.10	8.00	8.04
0:100	0	68.00	0.71	-	8.70	8.50	8.40	8.40	8.50
	1	68.38	0.69	-	8.50	8.40	8.20	8.20	8.33
	2	68.82	0.66	1.88	8.30	8.25	8.00	8.10	8.16
	3	69.16	0.64	2.60	8.10	8.10	7.90	7.90	8.00
CD at 5%	Treatment	0.01	0.01	-	0.05	0.05	0.04	0.06	0.01
	Storage	0.01	0.01	-	0.06	0.06	0.04	0.06	0.01
Treatment x Storage		0.02	0.01	-	NS	0.10	0.07	0.11	0.02

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