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Sandeep Kumar
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

Rakesh Gehlot
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

Rekha
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

Ritu Sindhu
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

Tanu Malik
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

Corresponding Author:
Sandeep Kumar
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, (Haryana), India

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

Sandeep Kumar, Rakesh Gehlot, Rekha, Ritu Sindhu and Tanu Malik

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Abstract
Chutney 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 chutney during storage. Chutney prepared with 40 guava:60 papaya pulp ratio was most acceptable. The overall acceptability of chutney decreased significantly during three months storage period.

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

Introduction
Guava (*Psidium guajava* L.) is one of the important commercial fruits belonging to family Myrtaceae. It is popularly known as "poor man's apple" and is a good source of dietary fibre and vitamin C (150 to 250 mg/100 g), with moderate levels of folic acid. It is a rich source of ascorbic acid in human diet, content of which is three to five times more than that in fresh orange juice. It also supplies essential dietary minerals like iron, calcium and phosphorous. It also contains substantial quantities of carbohydrates, sugars and pectin (Sahu *et al*., 2015) [10]. It is a climacteric fruit, which ripens rapidly after harvest, and loses its texture and quality in 3-4 days at room temperature. It contains a high percentage of their fresh weight as water and consequently exhibits relatively high metabolic activity, which continues even after harvest and makes it highly perishable commodity. It also possesses anticancer properties.
Papaya (*Carica papaya* L.) belongs to family Caricaceae. Due to its high nutritive value and reasonable price, it is known as common man's fruit. The fruits are rich in minerals like potassium, magnesium and folate, vitamins like vitamin A, vitamin C, vitamin E and some B group vitamins, flavonoids, β- carotene and fibre. It is also regarded as "the wonder fruit of the tropics and subtropics". It has anti-inflammatory, anti-tumour, anti-fungal, anti-bacterial and wound healing medicinal properties (Aravind *et al*., 2013) [2].
In terms of digestion, the latex and juice of fruit aid in dyspepsia, intestinal irritation, habitual constipation, chronic diarrhoea and coupled with them, bleeding piles, enlarged spleen and liver can also be improved. Papaya fruit is utilized in developing ready-to-serve drink, nectar, squash, sherbets, jam and candy slices to avoid extra glut during peak season.
Blending of papaya pulp with guava pulp can supplement its blended products with vitamins, minerals, besides improving its colour and appearance, taste, flavour and overall acceptability. Keeping the above aspects in view, the present research work was planned to standardize appropriate combination of guava-papaya blends for preparation of chutney 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, CCSHAU, Hisar and ripe papaya fruits were procured from local market, Hisar for collecting pulp for making jam from guava-papaya blends.

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
(after removal of 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 chutney 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 was cooked after mixing 400 g sugar, 1 to 2 g citric acid (as per blends), 200 g onion paste, 20 g ginger paste, 10 g garlic paste and 2.5 g red chilli powder. The mixture was cooked with constant stirring with a ladle. During cooking, 2 g pectin, 25 g salt and 8 g hot spice mix were mixed with the cooking mass and cooking was continued until it attained 50% TSS. Glacial acetic acid (5 ml) and sodium benzoate (500 mg/kg product) were mixed with the product. It 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 chutney (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 ingredients
(Onion paste, ginger paste, garlic paste, citric acid and red chilli powder)
↓
Cooking
↓
Mixing pectin, salt and hot spice mix
↓
Cooking until end point
(50% TSS)
↓
Mixing glacial acetic acid (5 ml) sodium benzoate (500 mg)
↓
Packing in 150 g capacity glass bottles
↓
Storing at room temperature
(21-35 ºC)

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

In chutney, total and reducing sugars were estimated by the method of Hulme & Narain (1931) [4]. Ascorbic acid was determined by method of Ranganna (2014) [8]. Total carotenoids were analyzed by Rodriguez-Amaya method (1999). Total phenols were analyzed by Amorim *et al.* (1997) [1] and browning was estimated by method of Ranganna (2014) [8]. The overall acceptability of guava-papaya chutney was based on mean scores obtained for all the sensory characters *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) [8]. 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.

Results and Discussion

There was a gradual and significant increase in total and reducing sugars of guava-papaya chutney with the advancement in storage duration. 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 Chaudhary and Verma (2012) [3] in aonla chutney. The ascorbic acid content decreased significantly in guava-papaya chutney 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 Mishra *et al.* (2011) [6] in ready-to-eat amla chutney. A significant decrease in total carotenoids of guava-papaya chutney 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 Teangpook and Paosantong (2013) in low sucrose lime juice papaya jam.

There was also significant decrease in total phenols of guava-papaya chutney 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 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 Shivani *et al.* (2008) [11] in jamun chutney. There

was significant increase in browning of guava-papaya chutney 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 discolouration. Similar increase in browning was also reported by Paravisini *et al*. (2018) [7] in apple juice.

Chutney prepared with 40 guava:60 papaya pulp ratio was adjudged as most acceptable. The overall acceptability of guava-papaya chutney decreased significantly during three months storage period. Similar results were reported by Veerapandian *et al.* (2014) [12] in ready-to-eat peanut chutney.

Table 1: Changes in chemical constituents and overall acceptability of guava-papaya chutney during storage

Treatments* Guava:papaya	Storage period (months)	Total sugars (%)	Reducing sugars (%)	Ascorbic acid (mg/100 g)	Total carotenoids (mg/100 g)	Total phenols (mg/100 g)	Browning (440nm)	Overall acceptability (9 point hedonic scale)
100:0	0	35.14	19.24	82.60	0.65	89.32	0.34	7.60
	1	35.91	20.72	71.48	0.63	87.24	0.36	7.44
	2	36.84	21.80	62.36	0.59	86.18	0.38	7.34
	3	37.62	22.54	55.14	0.54	84.74	0.41	7.18
60:40	0	36.52	20.32	45.54	1.94	67.46	0.24	8.51
	1	37.56	21.54	36.24	1.91	65.76	0.27	8.36
	2	38.24	22.48	28.18	1.87	63.56	0.29	8.21
	3	38.98	23.46	21.98	1.83	60.12	0.31	8.05
0:100	0	37.28	20.96	28.26	3.02	62.14	0.15	8.45
	1	38.04	22.38	21.62	2.98	60.56	0.18	8.31
	2	38.82	23.29	16.73	2.95	59.24	0.20	8.15
	3	39.56	24.02	12.22	2.91	57.88	0.22	7.96
CD at 5%	Treatment	0.01	0.14	0.02	0.01	0.01	0.01	0.04
	Storage	0.01	0.16	0.02	0.01	0.02	0.01	0.05
Treatment x Storage		0.01	0.28	0.28	NS	0.03.	NS	NS

*Recipe- One kg blended pulp; 400 g sugar; 1 to 2 g citric acid; 200 g onion paste; 20 g ginger paste; 10 g garlic paste; 2.5 g red chilli powder; 2 g pectin; 25 g salt; 8 g hot spice mix and 5 ml glacial acetic acid, NS- Non-significant

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