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Changes in chemical constituents and overall acceptability of guava-jamun cheese and toffee during storage

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Abstract
The guava-jamun cheese and toffee were developed and evaluated for changes in its chemical constituents and overall acceptability at monthly interval for three months storage period. Total sugars, reducing sugars and browning increased significantly, while ascorbic acid, anthocyanins and total phenols decreased significantly in guava-jamun cheese and toffee during three months storage. A significant decrease in overall acceptability of guava-jamun cheese and toffee was recorded during three months storage, however, both the blended products were found acceptable even after three months storage.

Keywords: Guava, jamun, cheese, toffee, chemical constituents, overall acceptability, storage

Introduction

Guava (*Psidium guajava* L.) is native to tropical America, which is now widely distributed throughout the tropical and subtropical areas of World. It contains 74-84 per cent moisture, 13-26 per cent dry matter, 0.8-1.5 per cent protein, 0.4-0.7 per cent fat and 0.5-1.0 per cent ash. The fruit is considered as an excellent source of vitamin C (150-250 mg/100 g) and pectin (1.15%). It has an appreciable quantity of minerals such as phosphorus (23-37 mg/100 g), calcium (14-30 mg/100 g), iron (0.6-1.4 mg/100 g) as well as vitamins like niacin, thiamine, riboflavin and vitamin A. It is very much relished for its fleshy texture, appealing flavour and delicious taste. It contains appreciable quantities of antioxidants like polyphenols and ascorbic acid that help in reducing incidence of many degenerative diseases like arthritis, arteriosclerosis, cancer, heart diseases, inflammation and brain dysfunction. Guava pulp is an excellent raw material for preparation of various products like ready-to-serve drink, nectar, jam, cheese, toffee, ice-cream topping, etc.

Jamun (*Syzygium cumini* L.) also belongs to *Myrtaceae* family. The fruit is gaining popularity among the consumers due to its balanced sugar, acid and tannin content. It is generally consumed fresh and is known to have nutraceutical and therapeutic properties. The fruit is an effective food remedy for curing diabetes, heart, bleeding piles and liver troubles due to its effect on pancreas. Since the fruit is a very rich source of anthocyanin, it possesses antioxidant properties too. It isminor fruit, enriched with flavonoids, essential oils, anthocyanins, phenolic compounds and other antioxidants. Jamun pulp contains 19.7 per cent carbohydrates, 0.7 per cent proteins, 0.1 per cent fat, 0.9 per cent fibre, 0.02 per cent calcium, 0.01 per cent phosphorous and 0.1 per cent iron. The fruits are processed to make jam, jellies, RTS drink, squash, syrup, vinegar, chutney, butter, slab, bar, cheese and toffee for its pleasing and attractive purple colour due to presence of anthocyanins. The surplus fruits can, therefore, be processed into excellent quality value added food products.

Consumers, generally, have less preference for guava products inspite of its good taste, flavour, and high nutritional and medicinal value. However, blending of its pulp with jamun fruit pulp may supplement its blended products with attractive colour, improved taste and flavour and increased nutritional and medicinal properties. Keeping this aspect in view, a study was conducted to standardize appropriate combination of guava-jamun blends for preparation of cheese and toffee, and also to assess the changes in chemical constituents and overall acceptability of the blended products during storage.

Materials and Methods

The present investigation was carried out in Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar during 2015-16. Uniformly ripe guava and jamun fruits were procured from local market, Hisar. The guava and jamun fruits were washed thoroughly and the pulp was extracted (Fig. 1 and 2).

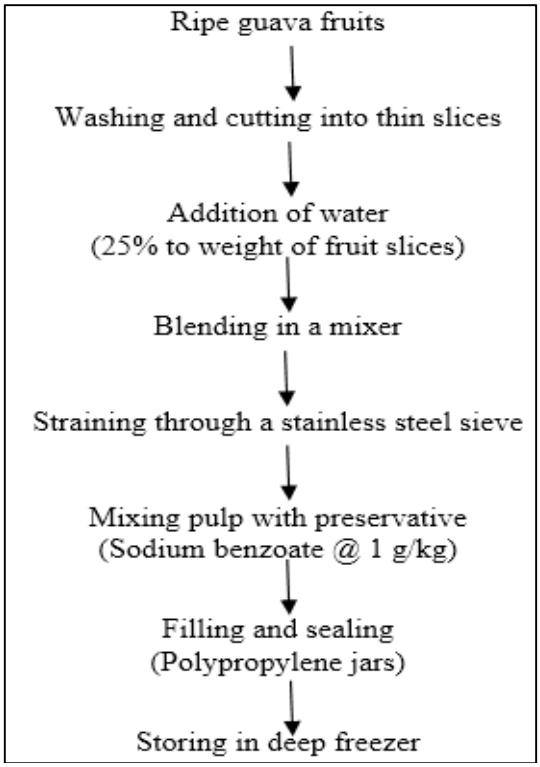

Fig 1: Flow sheet for extraction of pulp from guava fruits

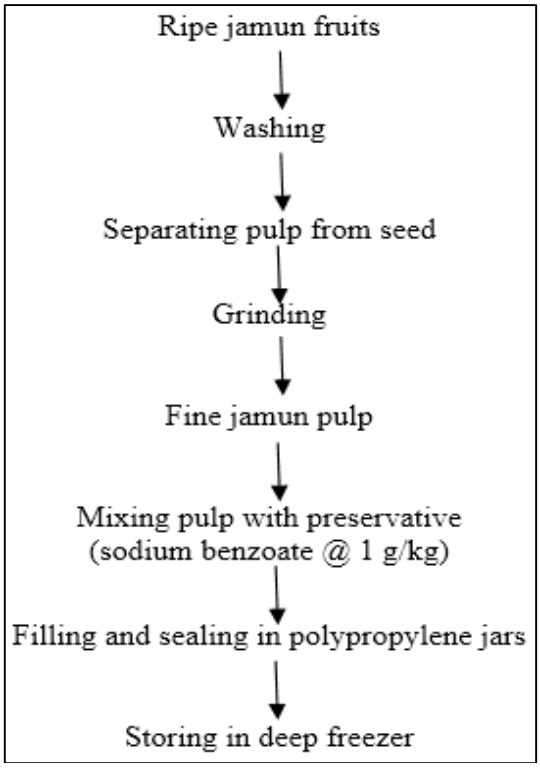

Fig 2: Flow sheet for collection of pulp from jamun fruits

The extracted guava pulp was blended with jamun pulp in 100:0, 80:20, 60:40, 40:60, 20:80 and 0:100 proportions. From these blends, cheese variants were prepared using 1 kg blended pulp, 800 g sugar, 70 g butter, 3 g citric acid and 3 g salt (Fig. 3). Pectin (2%) was also mixed with the cooking mass for proper setting of cheese. The mixture was cooked to obtain desired consistency of the product. The product was then spread on butter smeared trays and left for 5 to 6 hours for cooling and setting. Suitable size pieces of cheese were cut, wrapped in butter papers and packed in LDPE bags. Among these blends, one best blend (20 guava: 80 jamun) along with 100 guava: 0 jamun and 0 guava: 100 jamun was selected on the basis of sensory evaluation for storage study.

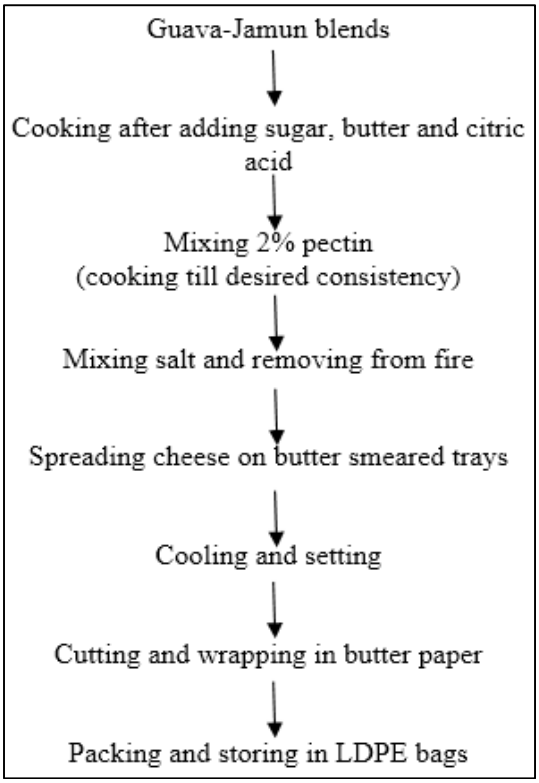

Fig 3: Flow sheet for preparation of guava-jamun cheese

Toffee was prepared from guava-jamun blends (100:0, 80:20, 60:40, 40:60, 20:80 and 0:100) using 1 kg blended pulp, 600 g sugar, 100 g commercial glucose, 70 g butter and 150 g skimmed milk powder as per standard procedure (Fig. 4). For preparing toffee, the pulp was cooked till its contents became one third of its original volume. At this stage, required quantities of sugar (600 g), commercial glucose (100 g) and butter (70 g) were mixed with the pulp and the contents were again cooked until the mass became sufficiently solid and started leaving sides of the pan. Skimmed milk powder dissolved in a little lukewarm water was mixed with the cooking mass and it was again cooked for 2 to 3 minutes. Cooked mass was rolled into sheets on butter smeared trays and left for 5 to 6 hours for cooling and setting. Toffees of suitable size were cut, wrapped in butter paper and packed in LDPE bags. On the basis of sensory evaluation, one best blend (40 guava: 60 jamun) was selected along with 100 guava: 0 jamun and 0 guava: 100 jamun for storage study.

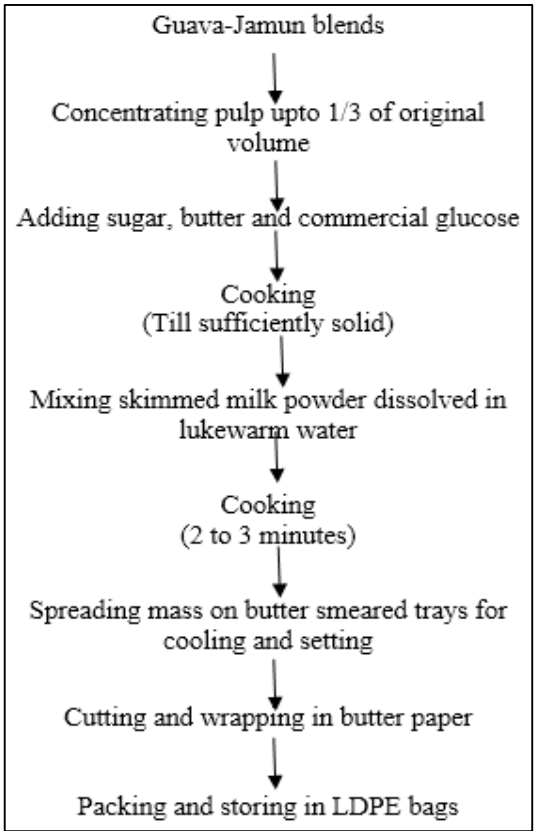

Fig 4: Flow sheet for preparation of guava-jamun toffee

Cheese and toffee were analyzed at monthly interval for changes in chemical constituents and overall acceptability during three months storage. Total and reducing sugars were estimated by the method of Hulme and Narain (1931) [4]. Ascorbic acid, anthocyanin and browning were analyzed by the methods of Ranganna (2014) [11], while total phenols were estimated as per the method given by Amorium *et al*. (1997) [1]. Cheese and toffee from guava-jamun blends were also subjected to sensory evaluation soon after preparation and after 1, 2 and 3 months of storage period by a panel of ten judges using 9-point hedonic scale as described by Ranganna (2014) [11]. The overall acceptability of cheese and toffee was based on mean scores obtained from sensory parameters *i.e.*, colour and appearance, flavour, texture, taste. The treatments were replicated thrice. The data were analyzed according to two factorial completely randomized design and were subjected to analysis of variance (ANOVA) technique. The critical difference value at 5% level was used for making comparison among different treatments during storage period.

Results and Discussion

There was a gradual increase in total sugars of guava-jamun cheese and toffee during three months storage (Table 1 and 2). This might be due to hydrolysis of polysaccharides like pectin, starch, etc. into simple sugars. Similar observations were recorded by Kohinkar *et al*. (2014) [7] in fig-guava toffee and Chavan *et al*. (2016) [3] in guava toffee. There was also significant increase in reducing sugars of guava-jamun cheese and toffee with the advancement in storage duration. The increase in reducing sugars might be due to inversion of non-reducing into reducing sugars and hydrolysis of polysaccharides. Kohinkar *et al*. (2014) [7] in fig-guava toffee and Chavan *et al*. (2016) [3] in guava toffee also found an increase in reducing sugars during storage.

Ascorbic acid is sensitive to heat and light, and is oxidized quickly in the presence of oxygen. Hence, it might have been destroyed during processing and subsequently during storage period. Similar reduction in ascorbic acid content was also recorded by Mewada *et al*. (2013) [9] in guava-papaya toffee and Chavan *et al*. (2016) [3] in guava toffee. Anthocyanins are responsible for bluish black or deep purple colour of jamun fruit and its processed products. Anthocyanins are phenolic compounds, which are highly volatile and are easily oxidized. It might have also decreased due to its condensation into brown pigments during storage. Similar results were reported by Kannan and Thirumaran (2001) [5] in jamun products and Shaheer *et al*. (2014) [12] in jamun juice. A gradual loss in total phenols was recorded in guava-jamun cheese and toffee during three months storage. The phenolic compounds are highly volatile and are easily oxidized. A gradual loss in total phenols was also recorded by Kapoor and Ranote (2015) [6] in pear-jamun juice. There was gradual increase in browning of guava-jamun cheese and toffee during three months storage. Similar observations were also reported by Singh *et al*. (1983) in guava cheese and Mall and Tondon (2007) [8] in guava-aonla blended beverage. The overall acceptability of guava-jamun cheese and toffee decreased significantly during three months storage period, however, both the blended products were found acceptable even after three months storage. This might be due to changes in chemical constituents or certain enzymatic and non-enzymatic changes in the products during storage. Loss of volatile aromatic substances responsible for flavour and taste might also have attributed to this decrease in overall acceptability of guava-jamun cheese and toffee during storage. Similar decrease in overall acceptability of the products during storage was reported by Chavan *et al*. (2015) [2] in guava-strawberry blended toffee, Chavan *et al*. (2016) [3] in guava toffee and Patel *et al*. (2016) [10] in guava cheese.

Table 1: Changes in chemical constituents and overall acceptability of guava-jamun cheese during storage

Treatments Guava: Jamun	Storage period (months)	Total sugars (%)	Reducing sugars (%)	Ascorbic acid (mg/100 g)	Anthocyanins (mg/100 g)	Total phenols (mg/100 g)	Browning (O.D. at 440 nm)	Overall acceptability (9 point hedonic scale)
100:0	0	57.68	31.09	44.03	ND	288	0.258	8.17
	1	58.13	31.54	40.34	ND	264	0.289	7.90
	2	58.58	31.99	36.40	ND	247	0.332	7.52
	3	59.03	32.44	32.71	ND	225	0.371	7.31
20:80	0	54.08	29.29	8.61	42.08	269	0.385	8.26
	1	54.53	29.74	7.79	40.32	250	0.419	7.97
	2	54.98	30.19	7.38	38.57	230	0.440	7.57
	3	55.43	30.64	6.15	37.06	208	0.470	7.42
0:100	0	53.62	28.84	ND	53.43	265	0.456	8.12
	1	54.08	29.29	ND	51.09	248	0.474	7.81
	2	54.53	29.74	ND	48.75	225	0.491	7.50
	3	54.98	30.19	ND	46.75	206	0.527	7.18
CD at 5%	Treatment	0.54	0.63	0.34	0.93	2.18	0.01	NS

	Storage	0.62	0.73	0.48	1.32	2.52	0.01	0.14
Treatment x Storage		NS	NS	0.68	NS	NS	NS	NS

ND- Not detected; NS-Non-significant

Table 2: Changes in chemical constituents and overall acceptability of guava-jamun toffee during storage

Treatments Guava: Jamun	Storage period (months)	Total sugars (%)	Reducing sugars (%)	Ascorbic acid (mg/100 g)	Anthocyanins (mg/100 g)	Total phenols (mg/100 g)	Browning (O.D. at 440 nm)	Overall acceptability (9 point hedonic scale)
100:0	0	65.34	33.34	50.67	ND	252	0.312	8.05
	1	65.79	33.80	46.24	ND	242	0.403	7.75
	2	66.24	34.25	42.31	ND	230	0.441	7.47
	3	66.69	34.70	36.65	ND	218	0.523	7.28
40:60	0	63.99	31.54	20.09	37.56	236	0.396	8.12
	1	64.44	31.99	18.86	35.48	227	0.512	7.82
	2	64.89	32.44	16.40	33.39	214	0.557	7.56
	3	65.34	32.89	14.76	30.89	195	0.717	7.36
0:100	0	63.54	31.09	ND	62.44	226	0.464	7.86
	1	63.99	31.54	ND	60.78	218	0.602	7.57
	2	64.44	31.99	ND	59.10	205	0.658	7.36
	3	64.89	32.44	ND	57.77	181	0.863	7.17
CD at 5%	Treatment	0.54	0.63	0.46	1.41	2.11	0.01	0.08
	Storage	0.62	0.73	0.65	2.00	2.44	0.01	0.09
Treatment x Storage		NS	NS	0.92	NS	4.22	0.02	NS

ND- Not detected; NS-Non-significant

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