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Development and evaluation of guava-jamun cheese and toffee

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Abstract
Guava-jamun cheese and toffee were developed and evaluated for changes in its nutritional constituents and sensory quality at monthly interval for three Months storage period. Ascorbic acid and anthocyanins decreased significantly in guava-jamun cheese and toffee during three Months storage. The colour and appearance, taste, flavour, mouthfeel and overall acceptability of guava-jamun cheese and toffee decreased significantly with the advancement in storage period, however, their overall rating remained above the acceptable level even after three Months storage. Cheese prepared with 20 Guava: 80 Jamun pulp was found most acceptable (7.80), while toffee prepared with 40 Guava: 60 Jamun pulp was found most acceptable (7.71).

Keywords: Guava, jamun, cheese, toffee, nutritional, sensory

Introduction
Guava belongs to family Myrtaceae and 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), pectin (1.15 per cent), 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. The antioxidant virtue in guava is believed to help reduce the risk of cancers of stomach, esophagus, larynx, oral cavity and pancreas. The vitamin C in guava makes absorption of vitamin E much more effective in reducing the oxidation of LDL cholesterol and increasing good cholesterol *i.e.*, HDL. The fibers in guavas promote digestion and ease bowel movements. Guava has excellent digestive and nutritive value, pleasant flavour, high palatability and availability in abundance at moderate price. Considering the unique blend of taste and nutrition, it is one of the most suited candidate fruits for value addition. A large number of processed products such as nectar, beverages, jam, cheese, toffee, etc. are manufactured from guava.
Jamun, also known as *Syzygium cumini* or Indian blackberry is one of the widely used plants for diabetic treatments by traditional practitioners. It is also used against numerous other medical conditions including microbial infection, oxidative stress, diarrhoea, ulcers and cardiovascular complications. Skin, pulp and kernel (seed without coat) of jamun are rich in phytochemicals and show high antioxidant potential. The fruit is sweet and tart and leaves a slight astringent action in the mouth. The ripe jamun fruit contains glucose and fructose, the major forms of sugar. It also contains vitamins C, vitamin A, riboflavin, nicotinic acid, choline, folic acid, malic acid, sodium, potassium, calcium, phosphorus, manganese, zinc and iron.
Jamun fruit is medicinally important due to its therapeutic values. 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. There is a great scope of processed products not only because of its exotic flavour, but also due to its nutraceutical importance. Blending of jamun pulp with guava pulp may supplement its blended products with attractive colour, improved taste and flavour and increased nutritional value and medicinal value. Keeping this aspect in view, the study was conducted to standardize appropriate combination of guava-jamun blends for preparation of cheese and toffee and also to assess the changes in nutritional and sensory quality of 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. Pulp was extracted from guava and jamun fruits as per standard procedure.

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. 1). 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.

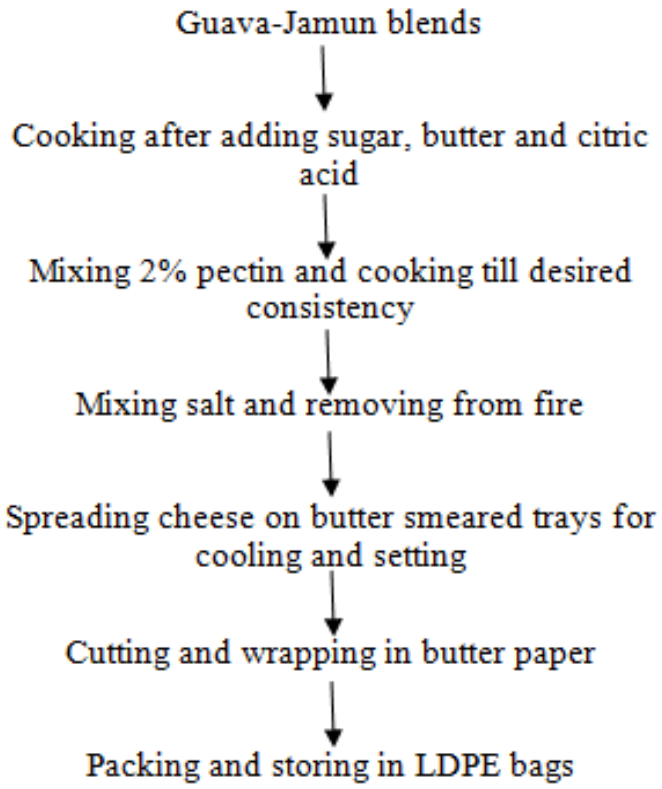

Fig 1: Flow sheet for preparation of guava-jamun cheese

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. 2). 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.

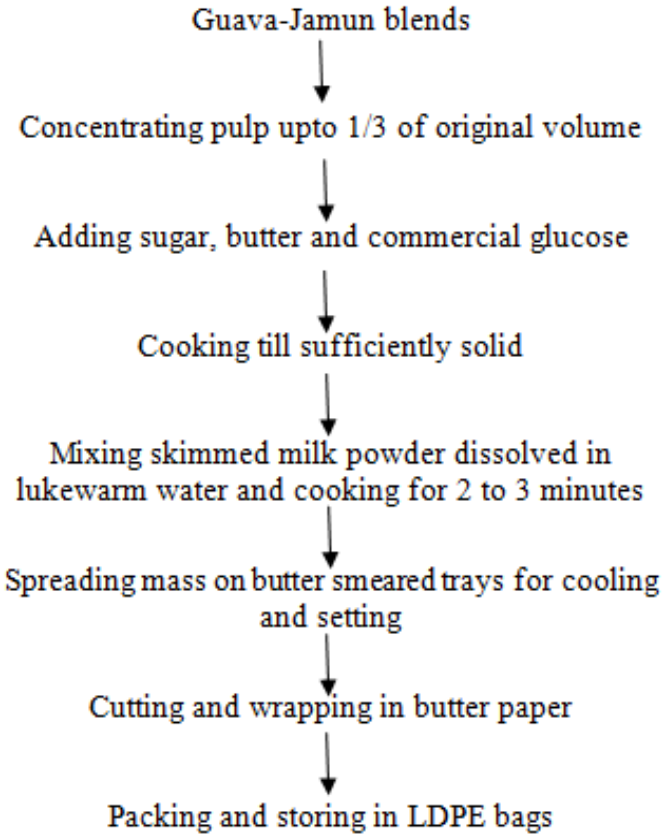

Fig 2: Flow sheet for preparation of guava-jamun toffee

Cheese and toffee were analyzed at monthly interval for changes in nutritional constituents and sensory quality during three months storage. Ascorbic acid and anthocyanin were analyzed by the methods of Ranganna (2014) [6]. 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) [6]. 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.

Table 1: Changes in nutritional constituents and sensory quality of guava-jamun cheese during storage

Treatments Guava: Jamun	Storage period (months)	Ascorbic acid (mg/100 g)	Anthocyanins (mg/100 g)	Colour and appearance (9 point hedonic scale)	Flavour (9 point hedonic scale)	Texture (9 point hedonic scale)	Taste (9 point hedonic scale)	Overall acceptability (9 point hedonic scale)
100:0	0	44.03	ND	8.20	8.00	8.50	8.00	8.17
	1	40.34	ND	7.90	7.60	8.20	7.90	7.90
	2	36.40	ND	7.45	7.40	7.70	7.55	7.52
	3	32.71	ND	7.25	7.35	7.40	7.25	7.31
20:80	0	8.61	42.08	8.30	8.05	8.40	8.30	8.26
	1	7.79	40.32	8.10	7.70	8.00	8.10	7.97

	2	7.38	38.57	7.60	7.50	7.50	7.70	7.57
	3	6.15	37.06	7.40	7.40	7.30	7.60	7.42
0:100	0	ND	53.43	8.25	7.75	8.30	8.20	8.12
	1	ND	51.09	7.85	7.55	7.85	8.00	7.81
	2	ND	48.75	7.55	7.30	7.50	7.65	7.50
	3	ND	46.75	7.20	7.10	7.15	7.30	7.18
CD at 5%	Treatment	0.34	0.93	NS	NS	NS	NS	NS
	Storage	0.48	1.32	0.28	0.34	0.37	0.33	0.14
Treatment x Storage		0.68	NS	NS	NS	NS	NS	NS

ND- Not detected; NS-Non-significant

Table 2: Changes in nutritional constituents and sensory quality of guava-jamun toffee during storage

Treatments Guava: Jamun	Storage period (months)	Ascorbic acid (mg/100 g)	Anthocyanins (mg/100 g)	Colour and appearance (9 point hedonic scale)	Flavour (9 point hedonic scale)	Texture (9 point hedonic scale)	Taste (9 point hedonic scale)	Overall acceptability (9 point hedonic scale)
100:0	0	50.67	ND	8.10	7.90	8.20	8.00	8.05
	1	46.24	ND	7.70	7.70	7.80	7.80	7.75
	2	42.31	ND	7.40	7.30	7.60	7.60	7.47
	3	36.65	ND	7.20	7.10	7.45	7.40	7.28
40:60	0	20.09	37.56	8.20	8.10	8.10	8.10	8.12
	1	18.86	35.48	7.85	7.80	7.75	7.90	7.82
	2	16.40	33.39	7.50	7.50	7.50	7.75	7.56
	3	14.76	30.89	7.25	7.30	7.25	7.60	7.36
0:100	0	ND	62.44	7.90	7.85	7.80	7.90	7.86
	1	ND	60.78	7.60	7.50	7.60	7.60	7.57
	2	ND	59.10	7.30	7.20	7.45	7.50	7.36
	3	ND	57.77	7.15	7.05	7.30	7.25	7.17
CD at 5%	Treatment	0.46	1.41	NS	NS	NS	NS	0.08
	Storage	0.65	2.00	0.31	0.37	0.31	0.37	0.09
Treatment x Storage		0.92	NS	NS	NS	NS	NS	NS

ND- Not detected; NS-Non-significant

Results and Discussion

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) [4] in guava-papaya toffee and Chavan *et al*. (2016) [2] 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) [3] in jamun products and Shaheer *et al*. (2014) [7] in jamun juice. A significant decrease in colour and appearance, taste, flavour, mouthfeel and overall acceptability of guava-jamun cheese and toffee was recorded during three months storage period, however, overall acceptability of both the blended products remained above the acceptable level 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 results were reported by Sharma (2014) [8] in jamun-mango jam, Sood (2015) [9] in jamun jam, Chavan *et al*. (2015) [1] in guava-strawberry blended toffee, Chavan *et al*. (2016) [2] in guava toffee and Patel *et al*. (2016) [5] in guava cheese.

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