Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 3450-3453
Received: 25-03-2019
Accepted: 27-04-2019

Sumit 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

Rattan Singh
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

Correspondence
Rattan Singh
Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar, Haryana, India

Changes in chemical constituents and overall acceptability of aonla-papaya toffee during storage

Sumit Kumar, Rakesh Gehlot, Rattan Singh, Rekha and Ritu Sindhu

Abstract
Toffee prepared from aonla-papaya blends was prepared and analyzed for changes in chemical constituents and overall acceptability at monthly intervals for three months storage period. Total sugars, reducing sugars and browning increased, while total carotenoids, total phenols and acidity decreased significantly in aonla-papaya toffee during three months storage. Toffee prepared with 80 aonla:20 papaya pulp ratio was found most acceptable. The overall acceptability of aonla-papaya toffee decreased significantly during three months storage period, however, the product was found acceptable even after three months storage.

Keywords: Aonla, papaya, blends, toffee, chemical constituents, overall acceptability, storage

Introduction
The food processing industry in India exhibits a bright outlook. The demand for value added food products is increasing gradually in India as well as in other countries due to increasing trend towards fast foods and changing consumer taste. The natural fruit products have high nutritional, medicinal and calorific values, which can further be improved by blending pulp or juice of two or more fruits having excellent colour and appearance, refreshing flavour, delicious taste, and high nutritive and therapeutic values.

Aonla (*Phyllanthus emblica* L. or *Emblica officinalis* Gaertn.) belongs to family Euphorbiaceae. It is one of the most important minor fruits of Indian origin, grown in arid and semi-arid regions. The fruit is acrid, cooling, refrigerant, diuretic and laxative. Aonla fruits are not consumed in fresh form due to its astringent and acidic taste; therefore, it is not popular as table fruit. The fruits are seasonal and perishable, so, there is a need to preserve it for use in off-season. Hence, it is necessary to process this fruit and develop innovative products with high nutritive value. Aonla fruits are already processed into a number of products like preserve, candy, juice, pickle, shreds, dried powder, chutney, etc. Dried fruits are also utilized in curing diabetes, fever, diarrhoea, dyspepsia, haemorrhages and cough (Bakshi *et al*., 2015) [4]. Now-a-days, blended products are gaining more attention by researchers due to supplementation of lacking nutrients in these products.

Papaya (*Carica papaya* L.) is the most economically important fruit in family Caricaceae. It is grown in tropical and subtropical climate, and is available throughout the year in India. The fruits are rich in nutrients especially β- carotene, which is converted into vitamin A in human body. It is also a rich source of minerals like potassium and magnesium, and nutrients such as vitamins C, vitamin E, flavonoids, vitamins B, folate, pantothenic acid and fibre (Ramachandran & Nagarajan, 2014) [12]. Various researchers utilize papaya fruits in developing ready-to-serve drink, nectar, squash, sherbets, jam and candy slices to avoid extra glut during peak season.

Fruit toffee is the product prepared by blending pulp/puree from sound ripe fruits, nutritive sweeteners, butter or other edible vegetable fat or milk solids and other ingredients appropriate to the product and dehydrated to form sheet, which are cut to desired shape or size. The product shall have moisture, TSS and fruit content not less than 20, 75 and 25%, respectively. Keeping all these aspects in view, the research work was conducted to standardize an appropriate combination of Aonla-Papaya blends for preparation of toffee and to evaluate the storage quality of blended product.

Materials and Methods
An investigation was carried out in Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar during 2016-17. Aonla cv. Chakaiya and papaya fruits were

procured from local market, Hisar. Aonla fruits were thoroughly washed under running water to remove dirt and other foreign materials attached on the surface of fruits.

The fruits were blanched in water containing 2% brine + 2% alum + 0.2% potassium meta-bisulphite (KMS) for 4 to 5 minutes. Aonla segments were then separated from its stone and grated in a food processor to obtain aonla pulp. Sodium benzoate (1000 ppm/kg pulp) was dissolved in small quantity of water and mixed with aonla pulp, packed in polypropylene jars and stored in deep freezer (-20^{0}C) for preparing toffee from aonla-papaya blends (Fig. 1).

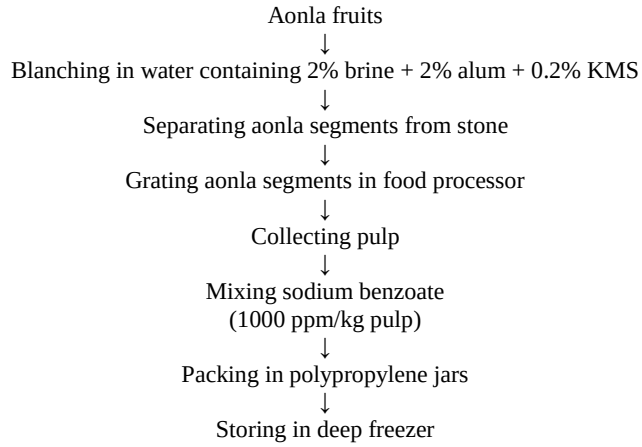

Fig 1: Flow sheet for collection of pulp from aonla fruits

Papaya fruits were washed thoroughly in running water, peeled off and cut into thin slices after removing seeds and inner white portion. Fine pulp was obtained by blending papaya slices in a mixer. Sodium benzoate (1000 ppm/kg pulp) was dissolved in small quantity of water and mixed with papaya pulp. Papaya pulp was then packed in polypropylene jars and stored in deep freezer (-20^{0}C) for developing aonla-papaya toffee (Fig. 2).

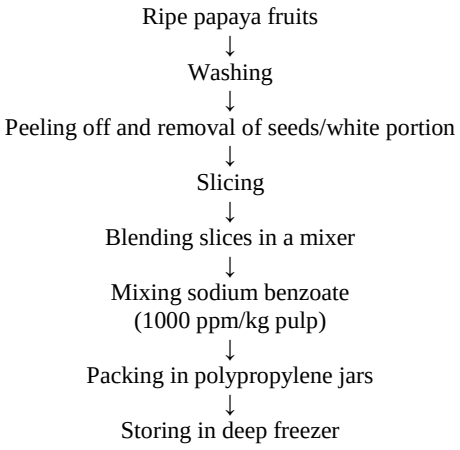

Fig 2: Flow sheet for collection of pulp from papaya fruits

Toffee was prepared from aonla-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 with 600 g sugar, 100 g glucose, 100 g butter and 160 g skimmed milk powder. Initially, the blended pulp was cooked until its contents remained one third of its original volume. At this stage, sugar, butter and glucose were mixed with the pulp and the contents were again cooked until desired consistency when it started leaving sides of the vessel. Skimmed milk powder dissolved in lukewarm water was mixed with the cooking mass. It was then cooked upto attainment of 75% TSS. Cooked mass was removed from fire and poured on butter-smeared trays. After cooling slightly, toffees were prepared by hands, wrapped in butter paper and packed into LDPE bags. Based on sensory evaluation of all products, Aonla-Papaya toffees (100:0, 80:20, 0:100) were selected for evaluating changes in chemical constituents and overall acceptability at monthly intervals during three months storage.

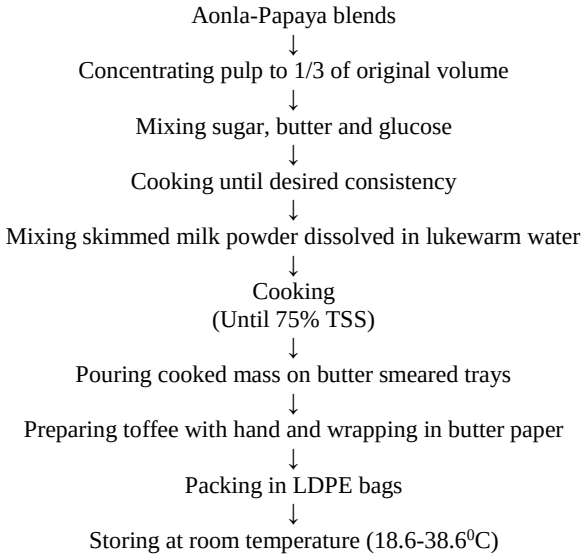

Fig 3: Flow sheet for preparation of aonla-papaya toffee

Aonla-Papaya toffee was analyzed for changes in chemical constituents and overall acceptability at monthly intervals for three months. Total and reducing sugars were estimated by the method of Hulme and Narain (1931) [8]. Acidity and browning were estimated by methods of Ranganna (2014) [13]. Total carotenoids were analyzed by Rodriguez-Amaya method (1999) [14] and total phenols were estimated as per the method given by Amorium *et al.* (1997) [1]. The overall acceptability of aonla-papaya toffee 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) [13]. 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

The perusal of data presented in Table 1 shows that there was significant increase in total sugars of aonla-papaya toffee during three months storage. The increase in total sugars might be due to hydrolysis of polysaccharides and inversion of sugars. Similar findings were reported by Chavan *et al.* (2016) [6] in guava toffee.

Table 1: Changes in chemical constituents and overall acceptability of aonla-papaya toffee during storage

Treatments* Aonla:Papaya	Storage period (months)	Total sugars (%)	Reducing sugars (%)	Acidity (%)	Total carotenoids (mg/100 g)	Total phenols (mg/100 g)	Browning (440 nm)	Overall acceptability (9 point hedonic scale)
100:0	0	60.56	34.06	1.06	0.11	92	0.670	7.9
	1	61.65	35.15	1.02	0.09	91	0.700	7.7
	2	63.45	36.05	0.93	0.08	88	0.733	7.4
	3	64.89	36.59	0.72	0.05	87	0.783	7.1
80:20	0	62.47	35.69	0.85	0.60	87	0.517	8.1
	1	64.53	36.02	0.80	0.54	84	0.520	8.0
	2	65.25	36.41	0.76	0.52	83	0.613	7.8
	3	65.97	37.31	0.68	0.48	81	0.683	7.4
0:100	0	62.37	36.25	0.20	1.67	76	0.423	8.4
	1	64.53	37.49	0.16	1.61	75	0.463	7.9
	2	65.97	38.21	0.12	1.55	72	0.630	7.7
	3	67.05	39.11	0.12	1.54	70	0.730	7.5
CD at 5%	Treatment	0.51	0.46	0.05	0.07	1.81	0.07	0.15
	Storage	0.59	0.54	0.05	NS	1.57	0.08	0.18
Treatment x Storage		NS	NS	0.10	NS	NS	NS	NS

*Recipe- 1 kg blended pulp, 600 g sugar, 100 g glucose, 100 g butter and 160 g skimmed milk powder; NS - Non-significant

Increase in reducing sugars of aonla-papaya toffee was also noticed during three months storage. This was mainly due to inversion of non-reducing into reducing sugars by acids present in product. The results of increase in reducing sugars of the products during storage are well supported by the findings of Anisa *et al*. (2016) [2] in peach-soy toffee.

The acidity in aonla-papaya toffee decreased significantly during three months storage period. The differences in quantities of citric acid and fruit pulp used in preparation of toffee might be responsible for change in acidity of the blended product. Similar decrease in acidity was found by Nalage *et al*. (2014) [10] in aonla-ginger mixed toffee and Anisa *et al*. (2016) [2] in peach-soy toffee.

Furthermore, the data indicate that there was significant decrease in total carotenoids of aonla-papaya toffee during three months storage. It might be due to thermo-labile, thermo-sensitive and epoxide forming nature of carotene compounds. The results are in conformity with those of Attri *et al*. (2014) [3] in papaya toffee.

There was significant decrease in total phenols of aonla-papaya toffee during three months storage. According to Kopjar *et al*. (2009) [9], total phenols decreased in the samples regardless of exposure to light or darkness because it was easily volatile and hence, got oxidized. Moreover, cell structure disrupted during processing and the materials became prone to non-enzymatic oxidation, which could also be one of the major causes for loss in total phenols of the products. Similar findings were observed by Deepika *et al*. (2016) [7] in aonla based fruit bars.

There was increase in non-enzymatic browning of aonla-papaya toffee during storage. The increase in non-enzymatic browning might be due to formation of furfural and hydroxyl furfural by aerobic and anaerobic degradation of ascorbic acid, sugars and organic acids. The results are confirmed with the findings of Nayak *et al.* (2012) [11] in aonla candy and Deepika *et al*. (2016) [7] in aonla based fruit bars.

After three months storage, the overall acceptability of blended toffee decreased significantly but remained acceptable. This might be due to changes in chemical constituents or certain enzymatic and non-enzymatic changes in the products. The decrease in sensory scores during storage was also observed by Chavan *et al*. (2015) [5] in guava-strawberry blended toffee and Chavan *et al*. (2016) [6] in guava toffee.

References

1. Amorium HV, Dougall DK, Sharp WR. The effect of carbohydrate and nitrogen concentrations of phenol synthesis in plant scarlet rose cells grown in tissue culture. Physiologica Plantarum. 1997; 39:91-95.
2. Anisa AM, Anju B, Vikas A, Rajkumari K. Preparation and evaluation of peach-soy fruit toffees. Journal of Food & Industrial microbiology. 2016; 2(2):2-5.
3. Attri S, Dhiman AK, Kaushal M, Sharam R. Development and storage stability of papaya (*Carica papaya* L.) toffee and leather. International Journal of Farm Sciences. 2014; 4(3):117-125.
4. Bakshi P, Wali VK, Jasrotia A, Sharma A, Iqbal M. Evaluation of different aonla (*Emblicaofficinalis*) cultivars under conditions of lower shivalik foothills of Himalayas. Indian Journal of Agricultural Sciences. 2015; 85(8):1012-6.
5. Chavan UD, Pawar UB, Pawar GH. Studies on preparation of mixed toffee from guava and strawberry. Journal of Food Science and Technology. 2015; 52(10):6791-6797.
6. Chavan UD, Shegade SL, Karma BR, Dalvi US. Studies on preparation of toffee from guava. International Journal of Advanced Research in Biological Sciences. 2016; 3(1):99-111.
7. Deepika, Panja P, Marak DS, Thakur PK. Effect of packaging on quality of enriched fruit bars from aonla (*Emblica officinalis* G.) during storage. International Journal of Agriculture, Environment and Biotechnology. 2016; 9(3):411-419.
8. Hulme AC, Narain R. The ferricyanide method for determination of reducing sugars. A modification of Hagedom-Jensen-Hanes technique. Biochemical Journal. 1931; 25:1051-1061.
9. Kopjar M, Pilizota V, Hribar, Simcic M. Total phenol content and antioxidant activity of water solutions of plant extracts. Journal of Food Science and Technology. 2009; 1(1):1-7.
10. Nalage AB, Chavan UD, Amarowicz R. Studies on preparation of mixed toffee from aonla and ginger. Italian Journal of Food Science. 2014; 26:26-133.
11. Nayak P, Tandon DK, Bhatt DK. Study on changes of nutritional and organoleptic quality of flavored candy prepared from aonla (*Emblica officinalis* G.) during

storage. International Journal of Nutrition Metabolism. 2012; 4(7):100-106.
12. Ramachandran P, Nagarajan S. Quality characteristics, nutraceutical profile and storage stability of aloe gel-papaya functional beverage blend. International Journal of Food Science. 2014; 3:460-461.
13. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, (2nd Ed.). Tata McGraw Hills Publishing Co. Ltd., New Delhi, 2014.
14. Rodriguez-Amaya DB. A Guide to Carotenoids Analysis in Foods. ILSI Press, Washington, 1999, 63.