Studies on development and evaluation of aonla-papaya cheese

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Abstract
Aonla-Papaya cheese was developed and evaluated for changes in its chemical and sensory quality parameters at monthly intervals for three months storage period. Total soluble solids increased significantly, while acidity, ascorbic acid, total carotenoids and total phenols decreased significantly in aonla-papaya cheese with the advancement in three months storage period. The colour and appearance, flavour, taste, mouth feel and overall acceptability of aonla-papaya cheese decreased significantly during three months storage duration, however, the product was found acceptable even after three months storage. Cheese prepared with 60 aonla: 40 papaya pulp ratio was found most acceptable.

Keywords: Aonla, papaya, blends, cheese, chemical constituents, sensory quality, storage

Introduction
Confectionery items are considered as broad segment of our market. Most of the confectionery products are prepared by flavour and concentrate of fruits; not directly from pulp that can harm our health but fruit cheese is the product prepared from pulp/puree of sound ripe fruits, whether fresh, frozen or previously preserved, by cooking with salt and nutritive sweeteners to obtain a thick consistency so that it sets on cooling. Cheese is neither too soft nor too hard to chew. It may be prepared from any of the suitable fruits, singly or in combination. It contains the original fruits flavour.

Aonla (Phyllanthus emblica L.) is one of the traditional fruits native to India and considered as “Wonder fruit for health”. Aonla is a member of family Euphorbiaceae and sub family Phyllanthidaceae. It is claimed to be the second richest source of natural vitamin C (600-900 mg/100 g) after Barbados cherry (Pokharkar, 2005) [10]. Other than ascorbic acid, the nutritional component pectin and minerals like iron, calcium and phosphorus are abundantly present in this fruit. The aonla fruits are generally not consumed fresh, as it is highly acidic and astringent, therefore, it is not popular as a table fruit, but has a great potential in processed forms. Several value added products have been developed from aonla such as pickles, preserve (murrabba), candy, sauce, chutney, jam, spread and ladoo.

Papaya (Carica papaya L.) is the most economically important fruit in family Caricaceae. It is grown in every tropical and subtropical country, 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) [11]. The extract of various parts of papaya has antioxidant, anti-hypersensitive, anti-inflammatory, anti-tumour, anti-fungal, anti-microbial, anti-sickling and anti-ulcer activity (Vij & Prashar, 2015). Due to faster fruit softening, consequent to ripening and huge transportation losses up to 40%, the fruit requires conversion into processed products. Papaya fruit is utilized in developing ready-to-serve drink, nectar, squash, sherbets, jam and candy slices to avoid extra glut during peak season.

Some consumers do not like the typical flavour of papaya pulp/juice; however, its blending with other fruit pulp/juice may provide processed products of better nutrition and sensory quality. Papaya pulp could be blended with fruit pulp or juice of aonla, rich in nutrients. Blending of papaya pulp with aonla pulp can supplement its blended products with vitamins (especially vitamin A), 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 aonla-papaya blends for preparation of cheese 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 2016-17. Aonla and papaya fruits were procured from local market of Hisar and washed thoroughly before extraction of pulp (Fig. 1 and 2).

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

Ripe papaya fruits ↓
Washing ↓
Peeling off and removal of seeds ↓
Slicing ↓
Blending slices in a mixer ↓
Mixing sodium benzoate (1000 ppm/kg pulp) ↓
Packing in polypropylene jars ↓
Storing in deep freezer

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

Aonla-Papaya cheese 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, 900 to 1000 g sugar, 0.6 to 3.0 g citric acid, 70 g butter, 5 g salt and 20 g pectin were used for preparation of aonla-papaya cheese. The mixture of blended pulp, sugar, butter and citric acid was cooked with a ladle with constant stirring to obtain desired consistency. Pectin dissolved in lukewarm water was then mixed with the cooking mass. Salt was mixed with the cooked mass, when it started leaving sides of the vessel. The end point was judged by sheet test and total soluble solids (68%) were measured using hand refractometer (58-92%). The product was spread on trays smeared with butter for cooling and setting. After setting, suitable size pieces of cheese were cut, wrapped in butter paper and packed in LDPE bags. Based on sensory evaluation of all the blended products, aonla-papaya cheese (100:0, 60:40, 0:100) were selected for further analysis for changes in chemical and sensory parameters at monthly intervals during three months storage period.

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

Aonla-Papaya blends ↓
Mixing sugar, butter and citric acid (as per recipes) ↓
Cooking with continuous stirring ↓
Mixing 2% pectin ↓
Mixing salt ↓
Removing from fire (68% TSS) ↓
Spreading cheese on butter smeared trays ↓
Cooling and setting ↓
Cutting and wrapping in butter paper ↓
Packing in LDPE bags ↓
Storing at room temperature (18.6-38.6°C)

Results and Discussion
The perusal of data presented in Table 1 show an increasing trend in total soluble solids of aonla-papaya cheese 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. Attr et al. (2014) [3] in papaya toffee and leather, and Chavan et al. (2016) [5] in papaya toffee also observed comparable increase in TSS of their products.

There were significant differences in acidity among different treatments of aonla-papaya cheese. The differences in amount of citric acid and fruit pulp used in preparation of cheese might be responsible for changes in acidity of the blended products. The acidity in aonla-papaya cheese also decreased
significantly during three months storage. Chavan et al. (2016) (3) in guava toffee and Anisa et al. (2016) (2) in peach-soy toffee reported similar grades of decrease in acidity. The ascorbic acid content decreased significantly in aonla-papaya cheese during three months storage. The factors for decrease in ascorbic acid content of the products include temperature, presence of oxygen in the package and light. It might be also due to oxidation of ascorbic acid into dehydroascorbic acid. The differences in ascorbic acid contents of blended cheese might be due to differences in the composition of raw materials in the recipes. Chavan and Shaik (2015) (4) in guava leather and Anisa et al. (2016) (2) in peach-soy toffee observed similar findings. There were significant differences in total carotenoids among different treatments of aonla-papaya cheese. This might be due to differences in composition of raw materials in the recipes. Furthermore, the data indicate that there was significant decrease in total carotenoids of aonla-papaya cheese during three months storage. It might be due to thermo-labile, thermo-stable and epoxide forming nature of carotene compounds. The results are in conformity with those of Atti et al. (2014) (3) in papaya toffee and leather. There was significant effect of different treatments on total phenols of aonla-papaya cheese. This could be explained due to the differences in composition of raw materials in the recipes. Decrease in total phenols of aonla-papaya cheese during three months storage was also found significant. According to Kopjar et al. (2009) (7), total phenol 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 be one of the major causes for loss in total phenols of the products. Patras et al. (2011) (9) in strawberry jam and Deepika et al. (2016) (6) in aonla based fruit bars obtained similar results.

There was a significant decrease in colour and appearance, taste, flavour, mouthfeel and overall acceptability of aonla-papaya cheese 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 after three months storage. The decrease in sensory scores during storage was also observed by Patel et al. (2016) (8) in guava cheese.

**Table 1:** Effect of storage on chemical and sensory parameters of aonla-papaya cheese during storage

<table>
<thead>
<tr>
<th>Treatments a</th>
<th>Aonla: Papaya</th>
<th>Storage period (months)</th>
<th>Total soluble solids (%)</th>
<th>Acidity (%)</th>
<th>Ascorbic acid (mg/100 g)</th>
<th>Total carotenoids (mg/100 g)</th>
<th>Total phenols (mg/100 g)</th>
<th>Colour and appearance (score out of 9)</th>
<th>Flavour (score out of 9)</th>
<th>Taste (score out of 9)</th>
<th>Mouth feel (score out of 9)</th>
<th>Overall acceptability (score out of 9)</th>
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<td>100:0</td>
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<td>0</td>
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<td>122</td>
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<td>97</td>
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</table>

*Recipe- One kg blended pulp, 900 to 1000 g sugar, 0.6 to 3.0 g citric acid, 70 g butter, 5 g salt and 20 g pectin

NS - Non-significant

**References**


12. Ranganna S. Handbook of Analysis and Quality Control