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Changes in chemical constituents of herbal banana-guava cheese during storage

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Abstract
Mulethi and satavar roots were processed to prepare powder and were used in the development of herbal banana-guava cheese. Cheese variants supplemented with 4% mulethi powder and 4% satavar powder were selected for preparation and evaluation of herbal banana-guava cheese variants. The products were evaluated for changes in chemical parameters at monthly interval for three months storage period. Total sugars, reducing sugars, acidity, non-enzymatic browning and peroxide value increased significantly, while ascorbic acid, total carotenoids, total phenols and water activity decreased significantly in herbal banana-guava cheese variants during three months storage.

Keywords: Banana, guava, herbal, cheese, mulethi, satavar, chemical, constituent, storage

Introduction
Banana (*Musa paradisiaca* L.) belongs to family Musaceae. Banana pulp contains 18% sugar and is also rich in vitamin A and B (Aurore *et al.*, 2009) [7]. According to Adamu *et al.* (2017) [1], it contains moisture (58.24g/100 g), carbohydrates (30.33 g/100g), protein (3.5 g/100 g), fat (1.30 g/100 g), crude fibre (3.53 g/100 g) and ash (3.10 g/100 g). Ripe banana has antioxidant properties and is rich in carotenoids (735 mg/100 g), ascorbic acid (12.7 mg/100 g), citric acid and malic acid (Kumar *et al.*, 2012) [11]. Various products like chips, ready-to-serve drink, flour, jam, confections, dehydrated slices, pickles and purees can be prepared from this fruit.
Guava (*Psidium guajava* L.) is a tropical fruit and belongs to family Myrtaceae. The fruit has about 83% moisture and is a good source of ascorbic acid. It contains about four times more the amount of vitamin C as present in orange. The guava fruits are available in surplus amount during certain period of the year and are spoilt in large quantities due to absence of post-harvest facilities. The fruits can be processed into acceptable products so that the growers may get the remunerative price of their produce and the consumers may also have the opportunity to enjoy guava fruits in processed form. The guava fruits are used in the formation of products such as jam, jelly, cheese, toffee, nectar, squash, vinegar, canned guava, etc.
Medicinal plants are the most exclusive sources of life giving drug for majority of World's population and nearly 80 per cent of people rely upon traditional medicines for their primary health care needs. *Glycyrrhiza glabra* L., commonly called *mulhatti*, liquorice or sweet wood is most commonly used due to its medicinal, aromatic and sweetening agent properties. Glycyrrhizin is the principle component to which the sweetness and medicinal properties of mulhatti are attributed. Satavar (*Asparagus racemosus*) belong to family *Liliaceae*. The roots of satavar contain saponins, sugars and mucilage. Fresh and dried tubers promote lactation, growth and act as brain tonic. Satavar is mentioned as rasayana, the rejuvenator herb, which improves health by increasing immunity, vitality and resistance.
Fruit cheese is a chewable confectionery item containing sugar, butter and fruit pulp as the major ingredients. Blending of pulp from two fruits in cheese contributes towards improving the vitamins and mineral contents of cheese (Adhau & Salvi, 2014**)**. The medicinal value of cheese can be enhanced by supplementing cheese ingredients with herbal powders. Keeping the above aspects in view, the present research work was planned to standardize processing technology for herbal banana-guava cheese using mulethi and satavari root powder (2, 4 and 6%) as herbal ingredients, and to evaluate the changes in chemical quality of the products during storage.

Materials and Methods

The present investigation was carried out in CFST, CCSHAU, Hisar during 2017-18. Banana and guava fruits were washed thoroughly before collection of pulp (Fig. 1 and 2).

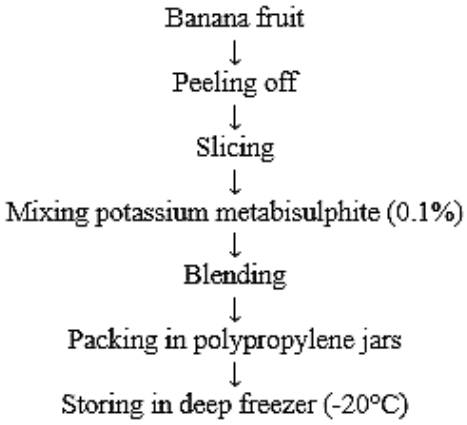

Fig 1: Flow sheet for collection and storage of banana pulp

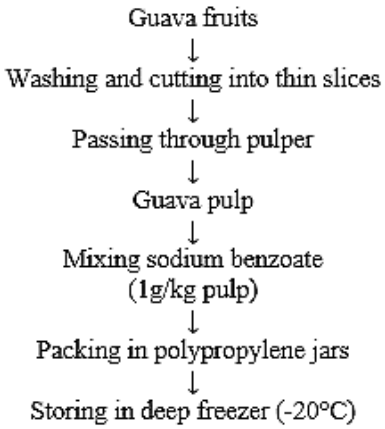

Fig 2: Flow sheet for collection and storage of guava pulp

Roots of mulethi and satavari were cleaned, washed and dried in cabinet dryer at 50°C. Dried roots were ground to fine powder in a hammer mill, packed in LDPE bags and stored at room temperature for use in standardization of processing technology for herbal banana-guava cheese.

Banana-Guava cheese (control) was prepared by using one kg blended pulp (40 banana:60 guava), 860 g sugar, 4 g citric acid, 70 g butter, 5 g salt and 20 g pectin (Fig. 3). The mixture of pulp, sugar, butter and citric acid was cooked with constant stirring with a ladle to obtain desired consistency. Pectin (20 g) dissolved in lukewarm water was mixed with the cooking mass. Herbal banana-guava cheese variants were developed by mixing mulethi and satavar powder (2, 4 and 6%) with the cooking mass after dissolving in little quantity of lukewarm water at the end point of cooking. Salt was mixed when it started leaving sides of the pan. End point was judged by sheet test and total soluble solids (68%) were measured using hand refractometer (58-92%). The product was finally spread on butter smeared trays and left for cooling and setting. After setting, cheese was cut into equal size pieces, wrapped in butter paper and packed in LDPE bags.

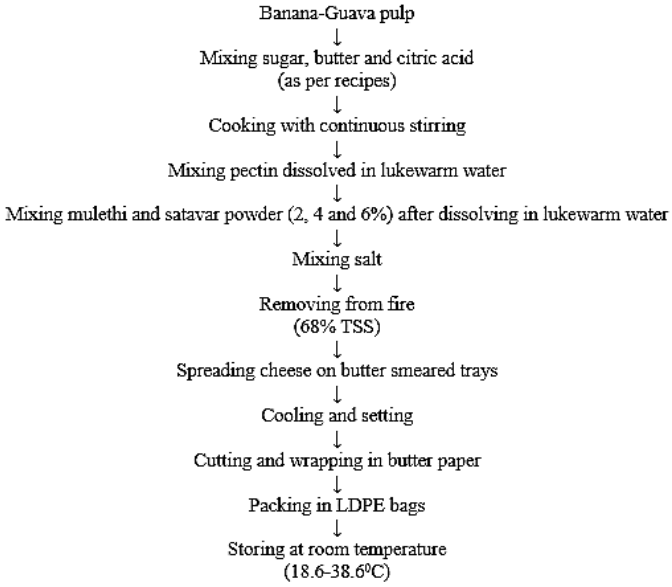

Fig 3: Flow sheet for preparation of herbal banana-guava cheese

On the basis of sensory evaluation, cheese variants supplemented with 4% mulethi root powder and 4% satavar powder were selected for preparation and evaluation of herbal banana-guava cheese variants during storage. Banana-Guava herbal cheese variants were developed and evaluated for changes in chemical parameters at monthly interval for three months. Total and reducing sugars in banana-guava cheese were estimated by titration method as suggested by Hulme & Narain (1931) [9]. Acidity, ascorbic acid and non-enzymatic browning were analyzed according to methods described by Ranganna (2014) [15]. Total carotenoids were estimated by Rodriguez-Amaya method (2004) and total phenols were estimated as per method suggested by Amorium *et al*. (1997) [4]. Peroxide value in herbal cheese was determined using standard method of AOAC (2005) [5]. The water activity in herbal cheese was assessed with the help of water activity meter (Rotronic Hydro Lab.).

Results and Discussion

The data in Table 1 show an increasing trend in total and reducing sugars of herbal banana-guava cheese during three months storage. The increase in total sugars of the products during storage might be due to hydrolysis of some carbohydrates like pectin, cellulose, starch, etc. and conversion of non-reducing to reducing sugars. Similar increase in total and reducing sugars of guava cheese during storage has also been reported by Sinha *et al*. (2017) [18] when prepared by value addition of 1.5% ashwagandha powder.

The acidity in herbal banana-guava cheese increased significantly during three months storage. The increase in acidity of the product might be due to degradation of polysaccharides, pectic substances and uric acid during storage. Similar increase in acidity during storage has been reported by Shabi *et al*. (2018) [17] in guava cheese.

Ascorbic acid content decreased significantly in herbal cheese variants during storage. The decrease in ascorbic acid of the products could be due to oxidation of ascorbic acid to dehydro-ascorbic acid with the passage of time. Similar finding was reported by Mehto & Mehto (2017) [12] in guava cheese.

Total carotenoids in herbal banana-guava cheese decreased significantly during 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 Aggarwal & Kaur (2014) [3] in carrot IMF and Attri *et al*. (2014) [6] in papaya toffee.

There was significant decrease in total phenolic content of herbal cheese with the increase in storage duration. The decrease in polyphenols of herbal cheese during storage might be due to oxidative degradation of phenolic compounds and its condensation into brown pigments. The results of the present investigation are in accordance with the findings of Deepika *et al*. (2016) [8] in aonla based fruit bars.

The non-enzymatic browning significantly increased in herbal cheese variants 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 also confirmed with the findings of Nayak *et al*. (2012) [13] in aonla candies.

A significant increase in peroxide value of herbal cheese variants was observed with the increase in storage period. The reason for increase in peroxide value of the products during storage is due to the fact that phenolic compounds, carotenoids and ascorbic acid content of fruits that helps in improving antioxidant activity and controlling peroxide value of the products got decreased during storage. The increase in peroxide value of cheese during storage was also reported by Khalil *et al*. (2019) [10] in fruit cheese supplemented with pomegranate and lemon peels extract.

The water activity in banana-guava cheese variants decreased significantly during storage. It might be due to loss of moisture content in cheese variants during storage. Decrease in water activity of product during storage was also reported by Panwar (2014) [14] in IMF aonla segments during six months storage.

Table 1: Effect of storage on chemical constituents of herbal banana-guava cheese variants

Treatments* Banana: Guava (40:60)	Storage period (months)	Total sugars (%)	Reducing sugars (%)	Acidity (%)	Ascorbic acid (mg/100 g)	Total carotenoids (mg/100 g)	Total phenols (mg/100 g)	Non-enzymatic browning (440 nm)	Peroxide value (meq./kg)	Water activity (a_w)
Control sample (40 Banana: 60 Guava)	0	57.30	34.80	0.80	30.96	0.52	17.63	0.219	0.13	0.75
	1	58.20	35.70	0.84	27.92	0.49	16.58	0.225	0.15	0.73
	2	58.90	36.50	0.86	24.86	0.47	15.51	0.230	0.17	0.71
	3	59.70	37.20	0.89	21.80	0.45	14.45	0.242	0.20	0.70
Cheese prepared with 4% mulethi powder	0	58.60	35.00	0.72	33.47	0.41	17.70	0.198	0.10	0.52
	1	59.30	35.90	0.75	30.43	0.39	16.64	0.206	0.12	0.50
	2	60.10	36.70	0.78	27.38	0.38	15.58	0.211	0.13	0.49
	3	60.90	37.50	0.80	24.32	0.37	14.50	0.218	0.15	0.48
Cheese prepared with 4% satavar powder	0	57.10	32.50	0.70	33.82	0.39	17.74	0.187	0.08	0.50
	1	58.00	33.70	0.72	30.78	0.37	17.65	0.192	0.10	0.49
	2	58.80	34.80	0.75	27.74	0.35	15.58	0.199	0.11	0.48
	3	59.70	35.70	0.78	24.67	0.34	14.56	0.208	0.14	0.47
CD at 5%	Treatment	0.09	0.07	0.03	0.05	0.09	0.02	0.026	0.02	0.22
	Storage	0.07	0.05	0.02	0.06	0.12	0.04	0.020	0.03	0.15
Treatment x Storage		0.17	0.13	NS	0.10	0.22	0.13	0.400	NS	0.40

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