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Guava cheese preparation to reduce the perishable loss of fruits and influence of the chemical composition during storage of cheese

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Abstract
Guava fruits have very short shelf life making it difficult for distant marketing. The processing for guava needs to be developed in order to lower the marketing costs and reduce wastage and losses in the production chain. Guava fruits were used to prepare guava cheese by standard method. The influence chemical composition and storability of guava cheese were evaluated on the basis of pH, total titrable acidity, ascorbic acid, reducing sugar, non-reducing sugar, total sugar and microbial counts were determined on 0, 30, 60 and 90 days of storage.

Keywords: perishable loss, shelf life, cheese, nutrition, surplus, additional income

Introduction
Guava cheese is made with fresh ripend fruits. They are a rich source of vitamin C from 3-6 times more than in oranges. Guava is a very popular fruit in India and thrives well both in tropical and subtropical climates. Guava is grown commercially in North India because of its higher yielding capacity and good economic returns. Guava makes significant nutritional contribution to human beings and cheaper source of the protective foods. The fruits of guava are available as seasonal surphlus during certain period of the year and are washed in large quantities due to absence of post-harvest facilities and know-how for proper handling, distribution marketing and storage. Therefore, it is needed to emphasise that the fruits of guava should be processed into acceptable products so that the growers get a remunerative price and consumers of all over the world, get the opportunity to enjoy the fruits of guava in the form of its products such as jelly, toffee, nector, squash, vinegar, canned guava, etc. Besides these products, guava has tremendous scope for the preparation of new products like "Cheese".

Material and Methodology
The methods adopted and the material used in carrying out this experiment is presented below:

Experimental Site
The experimental work of preparation of cheese from guava fruits was conducted in the laboratory of Horticulture Department, college of Agriculture, J.N.K.V.V. Jabalpur.

Flow chart of guava cheese preparation

Fresh washed fruits
↓
Skin the guavas cut into small pieces
↓
Put in a pressure cooker pan with ½ cup of water
↓
Cook for 10 minutes.
↓
Remove from heat
↓
Leave the cooker to cool down
↓
Open the cooker & remove the fruit pieces
↓
Mash nicely, strain to get the pulp, discard the seeds etc.
↓
Put the pulp in a vessel
↓
Adding salt, sugar & butter to the pulp
↓
Cook over low heat
↓
Remove from heat when mixture stants leaving sides of pan
↓
Add citric acid, mix well
↓
Leave to cool
↓
Evenly distributing over butter coated tray and left for 3 hrs. to set
↓
Storing in cool dry place

pH
The pH of the fruit as that of cheese was determined by using pH meter, which was standardized before use. The electrode of the pH meter was dipped into diluted cheese for 1 min and then pH was recorded. The electrodes of the pH meter were washed with distilled water after each determination.

Acidity (%)
Acidity was estimated by simple acid-alkaline titration method. 20 ml fruit juice was taken by pipette in a 100 ml flask, in which distilled water was added to make a volume up to 100 ml and

shaked, 25 ml diluted fruit juice was taken by pipette and transferred into a 250 ml beaker in which 3 drops of phenopthalene indicator was added and titrated with N/10 NaOH solution till the pink end point was reached. End point readings were recorded and the percentage acidity in term of citric acid was calculated by the following formula:
Total Acidity (%) = 0.128 x titration value

Ascorbic acid (Vitamin 'C')
Ascorbic acid was estimated as per assay method given by Rang Anna (1986)-

(a) Preparation of 3% Meta phosphoric acid (HPO_3)
For preparation of solution of 3% Meta phosphoric acid (HPO_3), 15 gm sticks or pellets of metaphosphoric acid was dissolved in 500 ml distilled water.

(b) Preparation of standard ascorbic acid
100 mg of 1-ascorbic acid was weighed and made upto 100 ml with 3% HPO_3. One ml of this solution was diluted to 10 ml by adding 3% HPO_3 (1 ml=0.1 mg ascorbic acid)

(c) Preparation of dye solution
52 mg of sodium salt of 2, 6-dichlorophenol indophenol was dissolved in 150 ml of hot distilled water containing 42-mg sodium bicarbonate. After cooling, it was diluted with 200 ml distilled water and stored in refrigerator and standardized every day.

(d) Standardization of dye
In 5 ml of standard ascorbic acid solution 5 ml of HPO_3 was added. Micro burette was filled with the dye solution. Standard ascorbic acid was titrated against dye solution to a pink colour, which persisted for 15 seconds. One milligram of ascorbic acid was used per ml of dye to determine the dye factor as follows:

$$\text{Dye factor} = \frac{0.8}{\text{Titre value}}$$

(e) Preparation of sample
Ten grams of sample was blended with 100 ml of 3% HPO_3 and after that it was filtered.

(f) Assay of ascorbic acid:
An aliquot (10ml) of the sample was taken and titrated against the standard dye to a pink colour end spoint, which persisted for 15 seconds. Ascorbic acid content of the sample was calculated by using the following formula:

$$\text{Ascorbic acid (Mg/100 ml juice)} = \frac{\text{Titre x Dye factor x Volume made up}}{\text{Aliquot of sample taken for estimation x weight of sample taken for estimation}}$$

Estimation of reducing and non-reducing sugars
The reducing and non-reducing sugars in the sample were determined by using Hane's Ferricyanide method.

Reagents
1. Absolute alcohol
2. Acid buffer solution – 3 ml glacial acetic acid, 4.19 g anhydrous sodium acetate, 4.5 ml of concentrated H_2SO_4 were dissolved and diluted to 1 litre.
3. Sodium tungstate solution – 12% (W/V)
4. Alkaline ferricyanide solution (0.1 N) – 33 g pure and dry $K_3Fe(CN)_6$ and 44 g anhydrous sodium bicarbonate were dissolved and diluted to 1 litre.
5. Acid salt solution – Dissolve 70 g KCL and 40 g $ZnSO_4$ in 750 ml of distilled water and 200 ml of glacial acetic acid was added gradually and diluted to 1 litre by distilled water.
6. Starch KI solution – 2 g of starch was dissolved in small quantity of distilled water and boiled with constant shaking with glassrod till the solution becomes clear. Now it was cooled and 50 g of KI was added and volume was made up to 100 ml 1 drop of standard NaOH was added to this solution.
7. Thiosulphate solution (0.1 N) – 24.62 g of $Na_2S_2O_3$, $5H_2O$ and 3.8 g of $Na_2B_4O_7.10H_2O$ (Borax) were dissolved and diluted to 1 litre with distilled water.

Procedure
5.657 g of powdered sample was taken in a 150ml conical flask and treated with 5 ml of absolute alcohol. The 50ml of acid buffer solution was added immediately. The flask was shaken to keep the sample into suspension; 2 ml of sodium tungstate solution was immediately added and mixed thoroughly. It was filtered with whatman filter paper No. 40 and the extract was taken for sugar estimation.

(a) Reducing sugar
5 ml of extract was taken in a test tube and 10 ml of $K_3Fe(CN)_6$ solution was added, then the tube was immersed in boiling water bath for exactly 20 minutes. Then the tube was cooled under running water and transferred at once into 100ml conical flask. Tube was rinsed with 25ml of acid salt solution. Then 1ml of starch KI solution was added and blue colour was developed. This was titrated with sodium thiosulphate solution till the blue colour was disappeared and white colouration was obtained.

(b) Non-reducing sugar
5ml extract was pipetted into test tube and immersed for 15 minutes in boiling water bath. Cool under running water and add exactly 10ml alkaline ferricyanide solution. It was titrated as described above for reducing sugar.
After substracting the values from blank reading maltose/sucrose mg/10 g of flour may be calculated by the table values given in AOAC (1970).

Table 1: Change in pH, total titrable acidity, ascorbic acid, non-reducing sugar, reducing sugar and total sugar content in guava cheese during 90 days storage.

Parameters	0 Day	30 Days	60 Days	90 Days
pH	4.27	4.21	4.17	4.12
Total titrable acidity (%)	0.34	0.31	0.29	0.26
Ascorbic Acid (mg/100g)	54.28	50.52	46.27	43.19
Non reducing sugar %	32.40	36.80	37.54	38.06
Reducing sugar %	26.13	29.47	32.51	37.48
Total sugar %	64.58	66.03	68.21	69.63

Table 2: Change in texture, colour/appearance and taste in guava cheese during 90 days storage.

Parameters	0 Day	30 Days	60 Days	90 Days
Texture	7.52	7.56	7.59	7.61
Colour/ appearance	7.67	7.63	7.60	7.57
Taste	7.41	7.35	7.32	7.30

Chemical characters of guava cheese

pH

The pH of guava cheese continued to decrease during storage (shown in table no. 1). It may also be due to increase in the hydrogen ion concentration of the guava cheese during storage.

Total titrable acidity (%)

During storage, there was a gradual reduction in acidity content with the increase in length of storage (shown in table no. 1). The decrease in acidity of guava cheese during storage is might be due to the utilization of acids for more stronger gel formation. It has also been observed in the sensory panelist that the gel was becoming more stronger.

Ascorbic acid (mg/100g)

The ascorbic acid content of cheese decreased during storage (shown in table no. 1). The loss of ascorbic acid may be due to oxidation process.

Sugar (%)

1. Increase in the non-reducing sugar during storage (shown in table no.1).
2. Reducing sugar content of cheese increased with the increase in storage period (shown in table no. 1). This phenomenon could be due to hydrolysis of polysaccharides and inversion of non-reducing sugar into reducing sugars.
3. There was a significant increase in total sugar content of cheese with increase in duration of storage (shown in table no. 1). The increase concentration of total sugar might be due to hydrolysis of polysaccharides like pectin, starch, etc. and their conversion into simple sugars.

Texture

Texture score in guava cheese increased with the advancement of the storage periods (shown in table no.2). This is due to addition of more amounts of sugar in preparation of guava cheese, which caused viscousness and less chewiness.

Colour/appearance

Colour/appearance score in guava cheese decreased with the advancement of the storage period (shown in table no.2).

Taste

Taste scores in guava cheese decreased during storage (shown in table no.2). An appropriate combination of acid and sugar results in the product with good taste**.**

Microbial analysis

Microbial analysis of guava cheese formulations was carried out by taking total plate count as per standard method.

Conclusion

On the basis of these investigations it was concluded that better quality of cheese could be obtained at ripened stage which had highest reducing sugar, total sugar, non-reducing sugar and least microbial counts. We have also concluded that during excessive production of guava, to reduce perishable loss of fruits, fruits cheese can be prepared and after marketing of guava cheese we get addition income.

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