STANDARIZATION AND PREPRATION OF *GUAVA LEATHER*

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ABSTRACT

The current study was investigated to analyse the preparation of guava leather of Ghola (Alahaabadi safaida) cultivars. Firstly the experiment were shown to find the concentration of sugar, citric acid, cinnamon, salt and packed in butter paper under storage temperature at (5+2^{o}C) for 45 days with the interval of 15 days study. The leather of guava (626.76 g/kg) pulp was attained from the T2 treatment (800 g sugar + 2 g citric acid + 2 g strawberry), surveyed by the other treatments like (619.06 g/kg) pulp in T4 (900 g sugar+2 g citric acid+1 g cinnamon). The average moisture content of fresh guava leather was 16.81 percent (14.98) Brix Total soluble solid, (77) percent reducing sugars, (14.32) percent total sugars, (6.72) percent titratable acidity,(0.541). The major ingredients including for the preparation of guava leather was sugar, citric acid, salt, cinnamon, and strawberry as a flavour. (Treatment T2 and T4) were higher as compared to the other treatments with respect of sensory evaluation. The average value of fresh fresh leather for appearance and colour was (8.5), flavour (7.51), taste and texture were approximately similar with the value of 8, and the acceptable level of sensory evaluation was 8.5 point Hedonic scale. As per the storage study showed that there was a gradual decrease in the moisture content, whereas Total soluble solid, total sugar reducing sugar and titrate able acidity were increased with the passage of time. During the storage study of guava leather sensory quality was decreased at little bit faster rate. Overall the quality of leather was acceptable even after 45 days storage study at refrigerated temperature.

Keywords:Guava, leather, Product Development, Guava Pulp, shelf life.

Introduction

Guava (Psidium guajava L.) subtropical and tropical drupe with sweet odour and sweet taste and pleasing sour, rich source of Ascorbic acid. Guava belongs to the family of Myrtaceae or

Myrtle supposed to be originated in Central America and Southern part of Mexico (Somogyi et al., 1996).

It is the fourth most important cultivated fruit in area and production after mango, banana and citrus. The production of guava in Pakistan is 58.5% thousand ha with the production of 468.3 thousand tones. It is grown in all the provinces of Pakistan mainly in Kasur, Lahore, shariqpur, sheikupora, Gujranwala, Haripur, kohat, bannu, north west frontier province, larkana, Sindh, hydrabad.

The guava fruit has moisture content nearly 83% and the range of vitamin C and pectin is respectively (100 – 265 mg/100 g pulp), (0.5 – 1.9 %), but has low protein content (1%) and low energy (66 cal/100g). The fruit is an excellence source of minerals like phosphorous (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, Pantothenic acid, Thiamine, Riboflavin, vitamin A (Bose et al., 1999).

Even without much care, guavas are reasonably hard, prolific bearers, and quite lucrative. Guavas are typically eaten fresh as dessert fruit because of their pleasingly sweet and reviving flavor.

One of the most delicious and comfortable fruits, whole fruit is edible, including the skin and seeds. It is frequently marketed as a "Marvelous fruit" and has significant nutritional value in terms of vitamins A and C, omega-3 and omega-6 polyunsaturated fatty acids, dietary fiber, riboflavin, proteins, and mineral salts found in the seeds. The higher vitamin C content in guava makes it a key player in the fight against free radicals and oxidation, which are major adversaries and the root of many degenerative diseases.

Guavas also have other qualities including antioxidants that can lower the risk of chronic diseases like pancreatic, stomach, and oral malignancies. Guavas' dietary fibers aid with digestion. Guavas include vitamin A, which is essential for maintaining healthy eyesight, teeth, skin, and bones.

Day by day consumer requirements are changing and the new products makes it more valuable and it has become imperious for producer to create new product with more nutritional value as well other health benefits. Overall it is an excellent source of digestive system and more nutrition, pleasant flavour, high sweetness and availability in abundance at reasonable price. The shelf life of fresh fruit is limited so that it is necessary to make different products to increase its shelf life and availability of guava fruit in off seasons and to stabilize the price over an extended period. In addition to being used as a stabilizer for other fruit juices or pulps, it can also be used in other processed forms such juices, jam, jellies, slices in syrup, fruit bars, or shriveled items (Laite et al., 2006). Guava is used to make delicious salad, pudding, jam, jelly,

cheese, canned fruit, RTS, nectar, squash, ice cream, and toffees (Jain and Asate, 2004). Because of their rising use in the tropics, there has been a bigger growth in the production rate of these fruits throughout time (FAO, 1983). In Pakistan, it is a normal occurrence for 20 to 25 percent of the fresh fruit to be entirely harmed and polluted before reaching the consumer. Consequently, it is using this at the time of production.

The process for making guava pulp is straight forward and has several applications. Fruit products that have been dried and made into leathers are pleasant and chewy. They provide a useful option to absorb fruit solids, especially for kids and teenagers, due to their new and appealing form and the fact that they are goods that do not require refrigeration. Fruit leathers make it possible to preserve more ripe fruits. Their popularity has grown recently, changing from a folk remedy to an industrial product. The literature that is currently accessible provides relatively little information on guava leather. As a result, the goal of this research is to learn more about the physicochemical qualities of guava, extend the fruit's shelf life, and develop a new off-season product.

MATERIALS AND METHODS

MATERIALS

Major ingredients are citric acid, salt, sugar, strawberry fruit, ripen guava fruit, cinnamon and packaging material (butter paper) were obtained from the local market of Haripur.

Methods

Physical features of fresh guava fruits

Guava fruit skin and colour:

Colour and skin of ripen guava fruit was observed visually.

2. Fruit Length

Ten different fruit were used for the length were examined with the help of Vernier calliper and the average value were taken in centimetre.

3. Diameter of fruit

Ten different fruits were used for the diameter of fruit mid-point was examined with the help of Vernier caliper and average value centimetre was noted. (Abbasi et al., 2011)

4. Weight

Weight of fruit was recorded with the help triple beam balance and average weight was taken of ten different fruit.

5. Pulp recovery of fresh guava fruit:

Clean and good quality fruit were used for the preparation of pulp. Pulp extractor machine was used for the extraction of pulp, the separation of seed from pulp and the pulp was obtained and was taken on the basis of percentage.

6. Waste material (seed)

Seed and waste material were calculated and weight was noted in percentage.

Physico-chemical study of fruit pulp and guava leather

The moisture, Brix, titrable acidity, reducing sugars, total sugars, and ascorbic acid content of the overripe guava fruit pulp were all measured.

Moisture content

Moisture content was analyzed by AOAC (2000) method No. 925.45. Shortly, china dishes were properly washed and then dried in the hot air oven at 105 º C. Then 10g of each guava pulp sample was taken in empty pre-weighed china dish. Total weight of china dish with guava pulp sample was recorded and then china dishes containing samples were placed in the hot air oven preheated to 105º C for about 16 hours. After drying, the dishes containing dried samples were placed in desiccators for some time and then reweighed. Process was repeated until the constant weight was obtained.

Following equation was employed to obtain moisture% in sample.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

W1 = weight of sample before drying : W_2 = weight of sample after drying

Total Soluble Solids

TSS of guava pulp was determined according to the AOAC (1990) Method No 932.12. Set the brix meter at zero with distilled water dry it with cotton put a drop of sample on it and note the reading then again dry it with cotton.

Titratable Acidity

Acidity of pulp was determined according to the AOAC (2000) Method No 942.15. Take 10 ml pulp raise the volume up to 100 ml with distilled water then add 2-3 drops of phenolphthalein indicator and titrate with 0.1N NaoH with continuous stirring till the color sample change to pink note the reading.

%Acidity can be calculated by using the following formula.

$$\text{\% Acidity} = \frac{0.1(\text{NaoH}) \times \text{titrate} \times 0.64}{\text{Volume of the sample taken}} \times 100$$

Total sugars

Guava pulp samples was analyzed for the estimation of total sugars (TS) contents according to (Lane and Eynon titration method) using Fehling's solution as reported in AOAC (2000) method No. 925.35. Fifty ml pulp was extracted from guava fruit then 5g citric acid was added in to the juice then the solution was boiled on hot plate for 5mins. After boiling 2 drops of phenolphthalein indicator was added in the solution and neutralized with 20% NaoH unti pink color then few drops of acid is added to regain the color, then the volume is raised up to 250ml with distilled water. In a separate flask 5ml of Fehling A and 5ml Fehling B solution was added and boiled on hot plate then 2 drops of methylene blue was added and then titrate with previous sample until the color change to brick red.

$$\text{Total sugar (\%)} = \frac{\text{Factor} \times \text{Dilution volume} \times 100}{\text{Sample volume} \times \text{Titer}}$$

Reducing sugars .

Sample was analyzed for the estimation of reducing sugar contents according to (Lane and Eynon titration method) using Fehling's solution as reported in AOAC (2000) method No. 925.35. Fifty ml pulp was extracted from guava fruit, 2 drops of phenolphthalein indicator is added in the solution and neutralized with 0.1 N NaoH until pink color then few drops of acid is added to regain the color, then the volume is raised up to 250ml with distilled water. In a separate flask 5ml of Fehling A and 5ml Fehling B solution was added and boiled on hot plate then 2 drops of methylene blue was added then titrated with previous solution until the color change to brick red.

$$\text{Reducing sugar (\%)} = \frac{\text{Factor} \times \text{Dilution volume} \times 100}{\text{Sample volume} \times \text{Titer used}}$$

pH Measurement:

Calibrate the pH meter with pH 4 and 7 buffers then wash the electrode with deionized water, dry it with cotton then dip it in the sample note the reading and wash the electrode again with distilled water.

Preparation of guava leathers:

Fresh fruits were cleaned, washed and then pulp was extracted with the help of pulping machine. Then the fresh pulp was used for the preparation of guava leather. In the prepared guava fruit leather (Fig.1) was cut into desired size and then wrapped into a butter paper.

Guava leather packaging and storage temperature:

Butter paper was used for guava leather packaging. The guava leather was first manufactured, sealed, and safely kept at a chilled temperature (7 + 2 oC) in a laboratory in the

refrigerator's middle compartment for 45 days of storage research. At intervals of 0, 15, 30, and 45 days of storage, guava leathers were subjected to chemical analysis and organoleptic evaluation.

Sensory evaluation of guava leathers:

sGuava leather samples were accepted for sensory evaluation using the Amerne et al. (1965) standard approach on a 9-point Hedonic scale. The samples were examined for appearance and color, flavor, texture, acceptability overall, and taste. All of the sensory metrics' average scores were kept.

Table.2 Ingredient levels for guava leather:

Treatment	Pulp(%)	Sugar(%)	Citric acid(%)	Salt(%)	Strawberry(%)	Cinnamon(%)
T1	100	100	2	1	10	_
T2	100	80	2	_	2	_
T3	100	75	2	2	5	_
T4	100	90	2	_	_	1
T5	75	70	2	2	30	_

Selection of guava fruits (over ripen)

↓

Washing

↓

Cutting into pieces

↓

Extraction of pulp by pulp extractor

↓

Addition of sugar, salt etc., /kg pulp

↓

Smearing on aluminum or stainless steel trays

↓

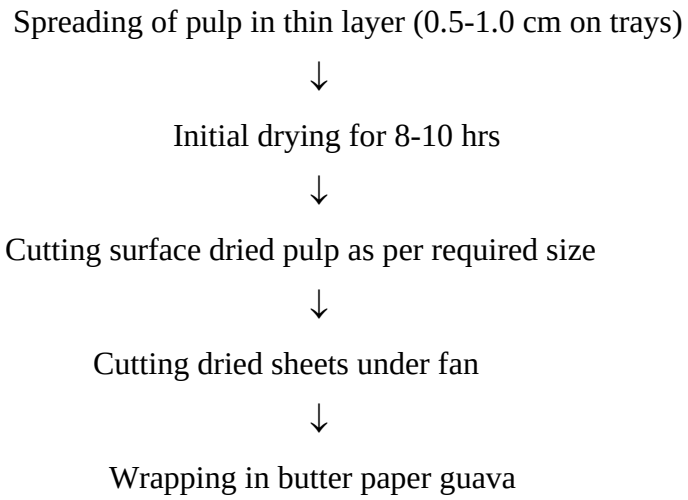

Figure. 1 Flow sheet for preparation of guava leather

RESULTS AND DISCUSSION

Guava is important for its nutritional and medicinal properties. Fruits are rich source of vitamin C, minerals, and polyphenols. Guava fruits are highly perishable in nature and difficult to transport and cannot be stored for long period. Hence, guava fruits need to be processed into new products. The preservation of guava fruit in the form of leather will help in better utilization of fruit.

Selected guava fruits of Ghola variety was washed, cleaned, then pulp was extracted and ingredients like sugar, salt, citric acid, strawberry fruit as a flavour and cinnamon are added as per treatments. Pulp was mixed, stirred well and dried in hot air oven under trays at 50-60 ºC. Dried leather was cut into proper size and packed in butter paper for storage at refrigerated temperature for 45 days. The effect of different treatments on the quality and shelf life of guava leathers were studied. These results are presented and discussed in this chapter.

Physio-chemical characteristics of Ghola or allahabadi safaida guava fruit and pulp:

The physio-chemical conformation of guava fruit is crucial to fruit processing technologies and the final product's quality. The round, golden Allahabadi safaida guava fruits were more fully mature. The average guava fruit weighed 142 g. The corresponding mean values for processing losses were 7.4%. Fruits were appealing, medium in size, and saffron yellow. It is suitable for both processing and eating purposes and has a better sugar and acid combination.

Sensory evaluation of guava leathers:

The second and third treatments four samples of guava leather are prepared and kept in a refrigerator for 45 days. For a 45-day storage study, leather samples were subjected to sensory, physical, and chemical testing at regular intervals of 15 days.

Table.3 Physical and chemical properties of Ghola Allahabadi safaida fruit and Guava pulp

Parameters	**Ghola Allahabadi safaida**
Physical factors of fruits	
Shape	Round
Colour	Yellow
length(centimetre)	6.32
weight(gram)	142.0
Diameter	6.32
Waste material (%)	37.5
Chemical constituents of Pulp	
TSS (Brix)	8
PH	4
Acidity (%)	1.345
Total sugar (%)	7.70
Reducing sugar(%)	5.30
Moisture (%)	84.54

Sensory characteristics properties of primary treatment of guava leather:

T2 and T4 were nominated among the 5 different treatments guava leathers (Table.4).

Table.4 Organoleptic evaluation of fresh variety of guava leather

Treatment	Physically appearance	Flavour	Taste	Texture	Overall acceptability	Selected/ Not selected
T1	8	7	7	7	7	Not selected
T2	8	8	8	8	8	**selected**
T3	6	6	6.5	7	6.5	Not selected
T4	7	8	9	8.5	8.5	**Selected**
T5	8.5	7	7	8.5	7	Not selected

Moisture:

The moisture content mean values are shown in table 5 below. When kept at a cold temperature for 45 days, the moisture content dropped from 14.98 to 14.24 percent. T4 was the more appropriate of the top two treatments in terms of moisture content, which was found to be at a higher level compared to the other treatments. Contrary to the current report, gradual decreases in moisture content over the course of storage have also been noted in mango leather (Rao and Roy, 1980), potato leather (Collins and Hutsell, 1987), dried fig leather, guava-papaya fruit mixed leather (Vennilla et al., 2004), fig leather (Kotlawar, 2008), mixed fruit jelly from fig and guava fruits mixed (Kohinkar et al (Chavan, 2015).

Total soluble solids TSS (0Brix):

The mean values for total soluble solids have been presented in the table 5. The Total soluble Solid content of leathers range start from 76 to 78 % from which T2 stored at refrigerated temperature had the highest value of TSS. Therefore other treatments showed lower value for total soluble solid. For lower values of moisture content, the largest value of total soluble solid may exist. Toffee manufactured from guava and strawberries has also raised TSS level due to loss in moisture value. The higher in TSS value during storage study was observed in fig (Gawade and Waskar, 2003), fig leather (Kotlawar, 2008), and figs (Gawade and Waskar, 2003). The findings of the current investigation confirmed those found in the literature.

Titratable acidity:

The mean values for titratable acidity have been presented in the table 6. The tritareable acidity of leathers greater in all treatments. The acidity ranges started from from 0.541 to 0.556 % at refrigerated temperature throughout storage study of 45 days. Due to the inclusion of citric acid in leather, T2 and T4 have higher levels of acidity overall. The increase in acidity value was noted in a variety of leathers, including fig leather (Kotlawar, 2008), guava leather (Rao and Roy, 1980), mango leather (Rao and Roy, 1980), mango bars (Mir and Nirankarnath, 1993), jackfruit bar (Krishnaveni et al., 1999), papaya-guava mixed fruit bar (Venilla et al., 2004), and mango leather (Muhammad, 2014). The current study's findings are consistent with earlier publications.

Table.5 The comparison between the chemical properties of fresh guava leather and storage period after 45 days

	Moisture (%)		TSS °(Brix)	
Treatments	**O Days**	**45 Days**	**O Days**	**45 Days**
T2	14.98 ±0.3716[a]	14.24 ±1.005 [a]	77± 0.288 [a]	77.5 ±0.288 [b]
T4	15.12 ±0.1955[a]	14.92 ±0.96 [a]	76.5± 0.5 [a]	77 ±0.288 [b]
MEAN	15.05 ± 0.4183	14.58 ±0.881	76.75± 0.516	77.25 ±0.316

Table.6 The comparison between the chemical properties of fresh guava leather and storage period after 45 days

	Titratable acidity (%)		PH	
Treatment	**0 day**	**45 days**	**0 day**	**45 days**
T2	0.541± 0.029 [a]	0.556 ±0.035[c]	3.86±0.03[a]	3.65±0.02 [c]
T4	0.462± 0.15288 [b]	0.472 ±0.047[c]	3.82±0.030 [a]	3.71±0.005 [b]
MEAN	0.5015± 0.1087	0.514 ±0.0385	3.75±0.032	3.76±0.038

`PH:

The mean values for have been presented in the table 6. The PH of fresh guava leather was 3.86 and 3.82 which was gradually reduced to 3.65 and 3.71 respectively for the period of storage.

Total sugars:

The mean values for total sugar have been presented in the table 7. The change in total sugar content of leather mentioned in Tables 5 and 6. Guava leathers showed a progressive rise in total sugar values over the course of storage. It might be caused by higher storage temperatures and a drop in leather's moisture content. During a 45-day investigation, the total sugar content of leather samples ranged from 68.72 to 68.73 % when kept at a cold temperature. Similar findings indicated that the total sugar content increased in jack fruit leather, fig and other fruit products, guava fruits, and mixed toffee made from guava and strawberry (Collins and Hutsell, 1987; Che Man and Taufik, 1995); sweet potato leather (Collins and Hutsell, 2014); and guava and other fruit products (Chavan, 2015). The outcomes of the current study are comparable to those that have been documented in the literature.

Reducing sugars:

The mean values for reducing sugar have been presented in the table 7. During the storage period, a significant divergence in the decreasing sugar content of leathers was found. The content of decreasing sugar leathers improves as storage research progresses. It can be the result of increased sugar overturn in leather samples during storage. Over the course of 45 days, the average reduction in sugar increased from 14.12 to 16.05% at a refrigerator temperature. Mango leather revealed similar results of an increase in reducing sugars (Rao and Roy, 1980)

Table.7 The comparison between the chemical properties of fresh guava leather and storage period after 45 days

	Reducing sugars (%)		**total sugar (%)**	
T	**0 day**	**45 days**	**0 days**	**45 days**
T2	14.32± 1.538 [b]	16.05 ±0.5147 [a]	68.72± 0.161 [a]	86.87 ±0.0721 [c]
T4	14.12± 0.100 [b]	15.99 ±0.46 [a]	68.23± 0.1684 [b]	68.61 ±0.023 [c]
MEAN	14.22± 1.115	16.02 ±0.651	68.475± 0.263606	77.74 ±10.0197

Changes on sensory properties of guava leathers during storage

Colour and appearance:

45 days of storage resulted in a score gradually dropping from 8.5 to 8. (Table 7). The T4 guava leather sample had a score of 8.5. Similar findings were made regarding the storage temperature of mango fruit bars, sweet potato leather, jack fruit leather, fig and other fruit products, guava-papaya fruit bars, dried figs, fig leather, guava-papaya fruit bars, and high protein tamarind leather. These findings were published in Doreyappa Gowda et al. (1995), Vennilla et al. (2004), Kotlawar (2008), and Doreyappa (Kharche, 2012).

Taste:

We looked at the drop in taste rating for guava leathers from 8.5 to 8 on the hedonic scale. The T4 leather samples received the highest flavor rating of 8.5 while kept in the refrigerator. It can be because the leather is reliable and the sugar and acid are mixed properly. According to Collins and Hutsell's 1987 study on sweet potato leather and the jack fruit leather, the taste score decreased during storage depending on the storage environment and the amount of time it was kept (Che Man and Taufik, 1995).

Texture:

Guava leathers' texture score dropped steadily from 8.5 to 8 in this study. The T4 sample kept at a refrigerator temperature had the highest score, 8.5. The hard effect of moisture content loss during storage research is what causes the texture score to decline. Earlier studies on potato leather (Collins and Hutsell, 1987), jack fruit leather (Che Man and Taufik, 1995), fig and other fruit derivatives yielded similar findings (Doreyappa Gowda et al., 1995).

Overall acceptability:

The drop of values from 8 to 7.5 in overall acceptability. The T2 treatment held at a cold temperature received the maximum score of 8.00. It can be the result of a quicker decrease in texture, flavor, and color. According to reports, the general acceptance score drops depending on the storage situation and time frame. Papaya leather (Harvey and Cavaletto,1978), mango fruit bars (Doreyappa Gowda et al., 1994), and jack fruit leathers have all demonstrated a decline in consumer acceptance (Che Man and Taufik, 1995).

Table.7 Organoleptic quality of guava leather after 45 days storage

Treatment	Colour and appearance	Flavour	Texture	Taste	Overall acceptability
T2	8.5 ±0.577 [a]	7.5 ±1 [a]	8 ±0.577 [a]	8 ±0.763[a]	8 ±1.0483 [a]
T4	7.5 ±1.2583 [a]	7.5 ±1 [a]	8.5 ±0 [a]	8.5 ±1.1547 [ab]	7.5 ±0.866 [a]
MEAN	8 ±0.9174	7.5 ±0.894	8.25 ±0.584	8.25 ±1.0327	7.75 ±0.8612

Conclusion

From the outcomes it is determined that the leather of guava prepared with sugar 800g, 20 ml strawberry as a flavour, 1 g cinnamon and citric acid 2 g per kg of guava pulp showed better sensory properties as well as good storage stability at refrigerated temperature up to 45 days storage period.

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