



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 836-840
Received: 01-09-2019
Accepted: 03-10-2019

Chandrakant Dongre
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Archana Khadse
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Kevin A Gawli
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Ashish Sarda
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Amol Nagmote
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Corresponding Author:
Chandrakant Dongre
Department of Horticulture,
School of Agricultural Sciences,
G. H. Rasoni University,
Saikheda, Chhindwara,
Madhya Pradesh, India

Study on quality and storage life of mixed fruit toffee prepared from guava and papaya

Chandrakant Dongre, Archana Khadse, Kevin A Gawli, Ashish Sarda and Amol Nagmote

Abstract

A field experiment was conducted with sixteen treatments in a factorial complete randomized design during the year of 2019 at Department of Horticulture, School of Agricultural Sciences, G. H. Rasoni University, Saikheda, Chhindwara, (M.P) to evaluate the study on quality and storage life of mixed fruit toffee prepared from guava and papaya, it is concluded that the various parameters of quality (organoleptic rating and storage of mixed fruit toffee over ail acceptability) and maximum net return of treatment combination i.e. 40% Guava and 60% papaya along with 300g sugar, 50g milk powder and 120g butter was found best and more ruminative. These findings may be useful for small scale industries.

Keywords: Quality, storage life, mixed fruit toffee, guava and papaya

Introduction

Guava (*Psidium guajava* L.) belongs to family Myrtaceae, is the fourth most important fruit crop in India as far as the area and production is concern after mango, banana, and citrus. It has been cultivated in India, since early 17th century and gradually become a crop of commercial significance. It is believed to have originated in Tropical America and is widely distributed over the Equatorial region of tropical and sub-tropical climate. At present, in India it occupies an area of 1.5 lakh ha with 1710.6 MT production and productivity of 20.1 tones/ha, (1st International Guava Symposium, 2005).

Papaya (*Carica papaya* L.) is an important and a very popular fruit crop of the tropical and sub-tropical countries of the world. It belongs to family caricaceae. The papaya is believed to have originated from Tropical America, perhaps in southern Mexico and Costa Rica. However, major papaya producing countries are Brazil, Nigeria, Congo, Indonesia, Malaysia and India, In India, it is cultivated in 65000 ha of land with production of about 14 lakh tonnes. The fruits are excellent source of vitamins "A" (2020 I.U./100g) next to mango (2500 I.U./100g) and also a rich source of vitamins like thiamine, riboflavin, nicotinic acid and ascorbic acid.

Guava and papaya are the commercial fruit crop of the western Madhya Pradesh and available on cheaper rates during winter season Unfortunately, papaya fruit has not caught the fancy of consumers as much as it deserves mainly because its odour is not highly appealing which also limits its commercial exploitation at processing level Whereas, guava emits a sweet aroma which is pleasant and refreshing acidic in flavour. Therefore, the blending fruit products could be an economic proposition to utilize them profitably. There is good possibility of enhancing the flavour and acceptability of papaya products by diversification i.e. by using blending technology. As the berry of guava fruit have pulp soft to melting, while flavour very pleasant, with excellent quality can be mixed with the berry of papaya fruit having pulp blood red colour, good taste, to give a quality products after blending. This shows their pulp compatibility and suitability for blending and making mixed fruit toffee not only chemical but physical characters too.

The storage of fruit is very difficult for longer period because of its perishable nature, especially under tropical condition. It is common experience that 20-25% fruits are completely damaged and spoiled before it reaches the consumers. Therefore, it is necessary to develop technology, for better utilization of such perishable fruits. Hence there is a great scope for processing of this fruit in the form of fruit toffee. Developing such processing technologies on blended products with these fruits may result not only in better utilization of these less exploited fruit crops and also to utilize the produce at the time of glut to save it from spoilage, in addition to the production of value added products along with gainful employment opportunities by starting small scale processing unit or cottage industry remunerative to growers.

Material and methods

The present investigation, "Study on quality and storage life of mixed fruit toffee prepared from guava and papaya" was conducted during the year 2018-2019 at PG Laboratory, Department of Horticulture, School of Agricultural Sciences, GH Raison University, Saikheda, Chhindwara, MP. The experiment was laid out in Factorial Complete Randomized Design with sixteen treatments comprising of Guava, Papaya and mixed pulp with the different concentration each having treatments. T1 (C1 + S1) 80% guava + 20% papaya, T2 (C1 + S2) 80% guava + 20% papaya, T3 (C1 + S3) 80% guava + 20% papaya, T4 (C1 + S4) 80% guava + 20% papaya, T5 (C2 + S1) 60% guava + 20% papaya, T6 (C2 + S2) 60% guava + 20% papaya, T7 (C2 + S3) 60% guava + 20% papaya, T8 (C2 + S4) 60% guava + 20% papaya, T9 (C3 + S1) 40% guava + 20% papaya, T10 (C3 + S2) 40% guava + 20% papaya, T11 (C3 + S3) 40% guava + 20% papaya, T12 (C3 + S4) 40% guava + 20% papaya, T13 (C4 + S1) 20% guava + 20% papaya, T14 (C4 + S2) 20% guava + 20% papaya, T15 (C4 + S3) 20% guava + 20% papaya, T16 (C4 + S4) 20% guava + 20% papaya. The field experiment was completed with four replications. The experimental data on observations were statistically analyzed by adopting the procedure of Panse and Sukhatme. The critical difference was calculated at five per cent probability level to draw statistical calculations.

Result s and Discussions

Sensory evaluation of pulp and mixed pulp of guava and papaya fruits

Colour

The significantly maximum 8.92 rating of colour was recorded in papaya pulp as compared to guava pulp (5, 69). As regard to mixed fruit pulp, the maximum 8.50 rating was found in 20% guava + 80% papaya pulp as compared to other ratio. The findings were quite similar as reported by various workers Hamanan *et al.*, 1980^[11], Ahmed *et al.* 2000 and Jain and Asati 2004^[13].

Flavour

The significantly maximum 8.82 rating of flavour was noted in guava pulp as compared to papaya pulp 7.54. Among the mixed fruit pulp the maximum 8.66 and 8.64 rating were exhibited in the mixed fruit pulp 80% guava + 20% papaya and 60% guava + 40% papaya, respectively. The findings of Hamanan *et al.* (1980)^[11], Ahmad *et al.* (2000)^[12], Jain and Asati (2004)^[13] are similar to that of the present findings.

Taste

Among the fruit pulp the 7.30 rating was recorded significantly maximum in guava pulp and between mixed pulp the 8.96 rating for taste was found maximum in 80% guava + 20% papaya pulp as compare to other ratio of mixed fruit pulp. The findings were quite similar as reported by Hamanan *et al.* (1980)^[11], Jain and Asati (2004)^[13] and Parmar (2008)^[18].

Texture

Texture of guava pulp was superior as compared to papaya pulp and maximum rating 9.03 was noted in guava pulp. The mixed fruit pulp ratio of 80% guava + 20% papaya was superior and recorded 8.90 rating as compare to other ratio. This result was in dose approximation to that of Hamanan *et al.* (1980)^[11], Jain and Asati (2004)^[13] and Parmar (2008)^[18] reported that similar result in ratio of fruit pulp in 75% guava + 25% papaya pulp.

Overall acceptability

An overall acceptability of guava pulp was recorded maximum 7.73 rating. Among the different ratio of guava and papaya pulp, the 80% guava + 20% papaya ratio was exhibited maximum 9.07 rating and best as compared to other ratio on the basis of sensory characters like colour. However, taste and texture, the findings were in agreement to Hamanan *et al.* (1980)^[11] reported that same parameters and similar results for pulp. Jain and Asati (2004)^[13] analyzed the guava pulp prepared from different guava cultivars and an overall acceptability of Allahabad safeda pulp was high. For evaluation of overall acceptability of ratio of pulp, Ramesh Kumar and Ilyas (2005)^[19] reported that sensory evaluation indicated all the combinations were acceptable but a ratio of 70% guava and 30% papaya having better overall acceptability and also that the colour of the product from guava - papaya pulp and brighter than raddish white that of pure guava leather as they have taken plain guava pulp as control. He also reported that blending had significant effect on the composition of finished product.

Qualitative characters of pulp and mixed pulp of guava and papaya fruits

Total soluble solids (°Brix) of fruit pulp and ratio of pulp

The guava pulp was recorded the 13.20 °Brix maximum total soluble solids as compared to papaya pulp. Among mixed pulp ratio the 80% guava + 20% papaya pulp was recorded the maximum total soluble solids 14.04 °Brix as compared to other pulp ratio. The total soluble solids content of fruits increases the taste and aroma of fruit, similar finding was in agreement with the Shrivastava and Shrivastava (1965)^[24], reported that the Allahabad Safeda fruits had maximum value of TSS. Similar results have been reported by Shankar *et al.* (1967), Mitra *et al.* (1983)^[16], Agrawal *et al.* (2002)^[1] and Parmar (2008)^[18].

pH

Maximum pH 6.21 was recorded in papaya pulp in comparison to guava pulp. In between mixed pulp ratio, the 20% guava + 80% papaya pulp was noted, as compared to other ratio 5.95 pH significantly higher of mixed fruit pulp. pH plays an important role in pulp preservation. The activities of microorganisms especially bacteria in low pH condition and vice versa. This finding is also in agreement with the findings of Hamanan *et al.* (1980)^[11] found that change in composition of stored pulp but showed no change of pH value of pulp. Sethi and Jindal (1997)^[23] reported that the pH increased with corresponding decrease in acidity and vice versa. This might be due to formation of organic acid by ascorbic acid degradation. Imran *et al.* (2000)^[12] noticed that the pH decreased significantly during storage of guava pulp. Parmar (2008)^[18] noted that pH value of leather increases with addition of sugar.

Acidity (%)

Significantly higher 0.46% acidity was exhibited in the guava pulp than the papaya pulp. However, the 0.53% acidity was found maximum in the ratio of 80% guava + 20% papaya pulp as compared to other ratio. The organic acid presents in the pulp influenced the colour, flavour, taste and keeping quality of pulp. They also influence the texture and appearance. Good acid and sugar ratio improved the sensory quality of pulp. Similar results have been reported by Shrivastava and Shrivastava (1965)^[24] that maximum value of acidity in guava fruit. Similarly Sachan *et al.* (1969)^[21]

reported that acidity is a major quality attribute of guava fruit. It affects the shelf life and organoleptic rating of fruit. Kumar and Honda (1974) [19] studied and found that the fruits of winter season were superior in quality as compare to rainy season. Kalra and Revanthi (1983) [14] reported that fruit of L-49 was recorded 0.45% acidity.

Ascorbic acid content

Guava pulp was exhibited higher 181.32 mg/100g ascorbic acid content. In case of different ratio of mixed fruit pulp, the 80% guava + 20% papaya pulp was noted maximum 197.03 mg/100g ascorbic acid. Ascorbic acid plays an important role in occurring good colour, flavour and aroma of pulp. This results is supported to findings of Shrivastava and Shrivastava (1965) [24], Shanker *et al.* (1967) [21], Kalra and Revanthi (1983) [14], Agrawal *et al.* (2002) [11]. Highest value of overall acceptability of Ci (80% guava + 20% papaya pulp) was perhaps due to the highest value of TSS (14.04 °Brix) and also 197.03 mg/100g ascorbic acid of mixed fruit pulp might have responded for good taste being the highest rating 8.96 and overall acceptability (9.07) in this combination.

Sensory evaluation of mixed fruit toffee

Colour

Colour of toffee increased with increased sugar content. It was further observed that the toffee colour rating was higher in recipe S3 (700 g sugar + 1 kg pulp). The results recorded that the stability in colour of guava and papaya toffee due to the presence of carotenoids (anthocyanin) in guava and persistence more colour in papaya is due to the presence of carotenoids (caricaxanthin) up to 90 days was perhaps due to dominant effect of papaya blending for colour appearance. Similar results have been reported by Baramanray *et al.* (1995) [5] and Baramanray *et al.* (1995a) [5] reported that colour of Guava nectar deteriorated with increase in storage time he reported that organoleptic quality of freshly prepared jelly to be highly acceptable and reduced significantly with increased storage period. Harsimrat and Dhawan (1998) [6] found that fruit bar of Allahabad safeda was superior followed by bar from 1-49.

Flavour

Flavour of toffee responded significantly to different treatment of ratio of pulp and recipes at all the stages storage period. Mean score of flavour rating decreased with increase sugar content in toffee above S2 recipes. Gradually increase of flavour of toffee to fruit ratio of C1 to C3 and results also indicated that favorable flavour persisted for longtime for storage of 90 days. These findings are in confirmation with findings of Baramanray *et al.* (1995) [5] and Baramanray *et al.* (1995a) [5] similar results reported that the flavour of jelly has higher in initial score but decreased significantly at 90 days of storage. Cherian and Cheriyan (2003) [9] reported that the blended leather was superior to most of the quality attributes. Prasad and Mali (2006) observed that flavour of bar jam remained optimum at low temperature.

Texture

Higher proportion of papaya pulp in comparison to the proportion of guava pulp was better in improving the texture of toffee. It might be due to presence of pectin in the papaya, which have the binding capacity and in addition to it the higher quantity of sugar S₂ (500 gm) gave better texture of toffee as in case of high sugar recipe S₄ (900 gm) makes toffee too hard. Similar results have been reported by

Baramanray *et al.* (1995) [5] evaluated organoleptic quality of freshly prepared jelly to be highly acceptable and reduced significantly with increased storage period. Aruna *et al.* (1999) [3] they observed higher deterioration in texture on 6 and 9 months storage at higher temperature in papaya fruit bar.

Taste

The best results of toffee taste were obtained from the treatment combination of C₃ Si (40% guava + 60% papaya pulp and 300 gm sugar) and which was significantly superior in comparison to other interactions. This taste was stable (very less reduction) for 90 days of storage as per their pulp compatibility. It also proved that the taste was due to the interaction effect of guava pulp, papaya pulp and sugar but when sugar quantity increases in toffee reduces the taste rating, which might be due to higher TSS value. Similar results were found by Baramanray *et al.* (1995) [5] and Baramanray *et al.* (1995a) [5] evaluated organoleptic quality like taste reduced significantly with increased storage period. Prasad and Mali (2006) reported that taste of ber jam remained optimum at low temperature.

Overall acceptability

An overall acceptability was depended upon texture, flavour, colour and taste as obtained through rating. In addition of these characters, overall acceptability also correlates with qualitative characters. Results that the C₃ ratio of fruit pulp of 40% guava + 60% papaya and Si recipe (300 gm sugar) was exhibited maximum rating of overall acceptability and interaction of both ratio of pulp and recipe was significantly superior in comparison to other interactions. It also proved that the overall acceptability was due to the interaction effect of optimum ratio of guava pulp, papaya pulp and sugar but when sugar quantity increases in toffee reduces the overall acceptability and makes toffee too hard. These findings are in confirmation with finding of Baramanray *et al.* (1995) [5] evaluated that organoleptic quality of freshly prepared jelly to be highly acceptable and reduced significantly with increased storage period. Similarly, Naikare *et al.* (1998) reported that organoleptic rating which was also found very good in leather. Babalola *et al.* (2003) reported that guava leather better result in overall acceptability at 0, 1, and 2 months of storage at 8+ or -1 °C.

Qualitative attributes of mixed fruit toffee:

Total soluble solids

As per the results recorded from the present investigation, revealed that the higher concentration of guava pulp in toffee increased TSS °Brix and this effect on TSS °Brix persisted till 90 days of storage. Similar effect of sugar contents of recipes Si to S₄, which also persisted for 90 days of storage. These findings are in confirmation with the findings of Kalra and Revanthi (1983) [14] reported a slight decreasing in TSS of guava pulp during 60 days of storage. Kalra and Tondon (1985) observed that the increase in TSS content did not persist same trend in all the cultivars. Baramanray (1995) [5] reported that TSS of guava nectar increased with the increase of storage period. The reasons assigned for the increase TSS content in nectar during storage might be due to conversion of left over polysaccharides into soluble sugar. Baramanray (1995a) [5] also reported that TSS of guava jelly significantly increased (9.49°Brix) in 90 days of storage. Similarly Sethi and Jindal (1997) [23] reported increase in TSS with increase in storage period of grape juice. Aruna *et al.* (1999) [3] reported

that papaya fruit bar stored at room temperature for 9 months. They noticed significantly changes in TSS with increased period of storage. Imran *et al.* (2000)^[12] and Bons and Dhawan (2003)^[6] also reported that TSS gradually increased in all samples of guava pulp during storage.

pH

An overall pH was observed to be less than 7.0 i.e. acidic. However, the pH value observed to be high at initial day of storage (0 day) in all the ratio of pulp of guava-papaya and recipe. The highest value of pH (6.47) of toffee was observed in ratio of fruit pulp C₄ (20% guava + 80% papaya). It was significantly highest values in all the treatments. Later on at 30, 60 and 90 days of storage period, these values of pH were decreased in all the treatments. It revealed that pH values were increasing as the proportion of papaya pulp in toffee was increased. However the pH value also reduced as the increase the storage period. As regards to interaction between ratio of pulp and recipe C4S1 was exhibited maximum 6.95, 6.81, 5.44 and 5.40 pH value of 0, 30, 60 and 90 days of storage period, respectively. The results supported by the results obtained of Kalra and Revanthi (1983)^[14] reported that slightly decrease in pH during 60 days storage of guava pulp. Sethi and Jindal (1997)^[23] reported that the acidity increased with corresponding decrease in pH. This might be due to formation of organic acid by ascorbic acid degradation. Imran *et al.* (2000)^[12] noticed that the pH decreased significantly during storage of guava pulp.

Acidity

The results obtained the promineny of pure guava pulp as increasing the order of proportion of guava pulp in the ratio of fruit pulp in comparison to papaya pulp, the percentage acidity increased. The order of acidity percent was increased in accordance to increase the percent of guava pulp from 20 to 80% with regard to the effect of sugar content in toffee, recipe

Si (0.389%) was effective in increasing acidity percent in comparison to other recipe. The highest significant value 0.457% of acidity was observed in the interaction of Ci Si. These findings are in confirmation with the findings of Chouhan (1981)^[8] observed that gradual decrease in acidity with increase in the period of storage in guava jelly. The decrease in acidity might be due to formation of sulphuric acid during storage. Saravanan *et al.* (2004)^[22] noticed a slight decrease in acidity of papaya jam, during storage. Similarly acidity reduction observed in the guava juice concentrate prepared from vacuum concentration method.

Ascorbic acid content

Ascorbic acid plays an important role in human nutrition. This would help to retain the colour, flavour and aroma of pulp and toffee. There was a prominent effect of higher proportion of guava pulp as evident from the ratio of fruit pulp of C₁ (80% guava + 20% papaya) and C₂ (60% guava + 40% papaya) an ascorbic acid content being the higher values 173.39 and 168.35 mg/100gm respectively in comparison to the values observed in lower proportion of papaya pulp. This pattern of these values was observed from 0 to 90 days through the quantity of ascorbic acid was decreased at storage. It was also evident from the value of ascorbic acid content of toffee in all the ratio of fruit pulp showed increasing trend with an increase in the sugar content. The ascorbic acid content was more in toffee with recipe S₄ (900 g sugar). These findings are in confirmation with the findings of Das *et al.* (1954)^[10] observed the losses of ascorbic acid during preparation and storage of dried mango pulp. Hamanan *et al.* (1980)^[11] studied the preserved guava pulp with potassium meta bisulphide plus sodium benzoate and found over 50% losses of ascorbic acid. Kalra and Revanthi (1983)^[14] reported that there is decrease in ascorbic acid content during storage of guava pulp. Similar results obtained by Ramana *et al.* (1984)^[20] for Totapari mango pulp.

Table 1: Effect of fruit pulp and mixed pulp ratio on various sensory (physical) and qualitative (chemical) parameters.

Fruit pulp and ratio	Physical parameters					Qualitative Parameters			
	Colour	Flavour	Taste	Texture	Overall acceptability	TSS (°Brix)	pH	Acidity (%)	Ascorbic acid content (mg/100g)
Guava pulp	4.70	8.29	7.56	9.43	8.12	14.99	3.96	1.18	126.60
Papaya pulp	6.00	8.00	7.42	7.96	7.81	16.98	3.94	1.15	124.00
Mixed pulp (% Guava + % Papaya)									
80 + 20	7.87	8.46	7.12	9.68	7.48	13.27	3.87	1.16	120.65
60 + 40	6.30	8.55	7.55	9.73	7.53	14.54	3.89	1.21	121.00
40 + 60	7.63	8.57	7.57	9.78	7.58	13.34	3.80	1.17	117.64
20 + 80	8.60	8.62	7.62	9.79	7.59	11.54	4.05	1.19	117.00
SEm±	0.2378	0.0131	0.1387	0.0176	0.4879	0.3823	0.0199	0.0147	0.0213
CD at 5% prob. Level	0.5042	0.0277	0.2941	0.0374	1.034	0.8104	0.0422	0.0311	0.0452

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