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ISSN: 0974-4908
Res. Environ. Life Sci.
9(4) 421-425 (2016)

Studies on the sensory quality and storage of jamun juice blended with guava juice

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(Received: June 27, 2015; Revised received: February 06, 2016; Accepted: February 09, 2016)

Abstract: An experiment was conducted to investigate sensory quality and storage of jamun juice blended with guava juice at ambient condition during 2013-2014 in postharvest technology laboratory at College of Horticulture, Mojerla, Mahabubnagar District, Telangana State.The investigation comprised of six treatments *i.e.* 100 % Jamun juice + 500 ppm Sodium benzoate (T_1), 90 % Jamun juice + 10 % Guava juice + 500 ppm Sodium benzoate (T_2), 80 % Jamun juice + 20 % Guava juice + 500 ppm Sodium benzoate (T_3), 70 % Jamun juice + 30 % Guava juice + 500 ppm Sodium benzoate (T_4), 60 % Jamun juice + 40 % Guava juice + 500 ppm Sodium benzoate (T_5), 50 % Jamun juice + 50 % Guava juice + 500 ppm Sodium benzoate (T_6) replicated four times in completely randomized design with factorial concept. The results revealed that, the Total Soluble solids, pH, ascorbic acid, total sugars increases and titrable acidity, anthocyanin content and total phenols gradually decreased during the storage period. The highest overall acceptability was recorded in the treatment T_3 (4.46). Among the treatments the highest total sugars was observed in T_3 (7.61) and lowest in T_6 (6.18). The highest anthocyanin content was recorded in T_1 (48.72) and lowest in T_6 (46.77). Whereas, the lowest microbial content was observed in T_3 (2.48) and highest in T_6 (2.76).

Key words: Jamun juice, Sodium benzoate, Blends, Anthocyanin, Phenols

Introduction

Jamun (*Syzygium cumini* L. Skeels*)* is an evergreen tropical tree belongs to the family Myrtaceae. According to Hindu tradition, Rama subsisted on the fruit in the forest for 14 years during his exile from Ayodhya. Because of this, many Hindus regard jamun as a 'Fruit of the Gods'. It has recently attained major importance as an arid zone Horticultural crop because of its hardy nature and high yielding potential. It is known by several names, such as black plum, Indian black berry and java plum. The world production of jamun is estimated at 13.5 million tonnes out of which 15.4 per cent is contributed by India. In the world, India ranks second in production of jamun. Maharashtra state is the largest producer followed by Uttar Pradesh, Tamil Nadu, Gujarat, Assam and others (Anonymous, 2005). The jamun fruits possess several medicinal and nutritive properties. The unripe fruit juice is stomachic, carminative and diuretic in nature and has cooling and digestive properties (Kirtikar and Basu, 1975). The seeds contain about 19 per cent tannins. Powdered seeds are used to treat against diarrhoea, dysentery and for reducing the sugars in the urine. It is also used as lotion for curing ring worm (Dastur, 1952) and against bleeding piles, correcting liver disorders, jaundice, kidney stone, asthma, blood pressure etc (Joshi, 2001).

Guava (*Psidium guajava* L) fruit is considered as one of the delicious and luscious fruit. It is rich source of vitamin C and also contains appreciable amount of minerals, vitamins, proteins and sugars. The fruit is one the richest source of vitamin C content. It contains four times more vitamin C than some citrus fruits. The guava contains very little vitamin A or carotene. However, it is fairly rich in most other mineral nutrients. It has very pleasant flavour and taste with good nutritional quality but fruit pulp is not attractive in colour. On the other hand jamun pulp has attractive colour and also the richest source of vitamin C and other antioxidants. Therefore, if pulps of both fruits are blended, there is a possibility to obtain a new beverage of attractive colour, pleasant flavour, highly nutritional, refreshing and medicinal properties along with good organoleptic value and storage stability.

Sometimes two or more juices are mixed to yield a well-balanced, rightly flavoured, colored, highly palatable and refreshing drink. Juices are blended so as to utilize a too sweet, a bitter fruit, too acidic or tart fruits, blend and insipid tasting fruits and strongly flavoured fruits. The blending of fruit drinks could be an economic requisite to utilize profitably some fruit varieties for processing and developing a new product.

Materials and Methods

The locally available jamun fruits were collected from a single tree, located in farmer field, near to College of Horticulture, Mojerla, Mahabubnagar District. Unblemished, riped and good quality jamun fruits were washed thoroughly with clean tap water, hand crushed, destined and pulp was heated up to 70ºC for two minutes. It is useful for easy separation of the seeds from pulp. The juice was extracted by squeezing pulp and then straining through muslin cloth. Then the juice was heated till it reaches 90ºC temperatures (Srivastava and Sanjeevkumar, 1998). Guava fruits were collected from orchards located at Shadnagar, Mahabubnagar District. Good quality guava fruits were washed thoroughly with tap water and cut into pieces. Then grind the pieces finely with water

(1 kg fruits: 1lit water) in a grinder. The juice was extracted by filtering through muslin cloth (Lal *et al*., 1986). In case of treatment T_1 (100 % Jamun juice), only jamun juice preserved and added with 500 ppm sodium benzoate, that means 100 mg of sodium benzoate added to the 200 ml of juice. In case of T_2 to T_6, the jamun juice of 90 %, 80 %, 70 %, 60 % and 50 % was taken and mixed with guava juice at 10 %, 20 %, 30 %, 40 % and 50 % respectively. All these treatments were added with 500 ppm sodium benzoate as preservative. After imposition of treatments, the blended juice were filled into clean, sterilized crown bottles of 200 ml capacity and sealed with crown caps by using crown corking machine and then stored at ambient condition for further observations

The study was carried for three months and analysis was carried in an interval of 15 days, all the treatments were replicated four times in completely randomized design with factorial concept. Total soluble solids (TSS) were determined with a digital refractometer by placing a drop of the filtered juice in the prism of the refractometer and results were recorded. The pH of the products was determined by using pH meter. Ascorbic acid was estimated by Indophenol method, total sugars by Lane and Eynon method and acidity was estimated by adopting the procedure described by Ranganna (1986). Anthocyanins were estimated by adopting the procedure bisulphate bleaching method and phenols as per the Folin Ciocalteau Reagent method (Bray and Thorpe, 1954). For estimating the microbial population in different sample products, dilution plate method was followed (Cruick Shank *et al*., 1975). Organoleptic evaluation was done by a panel of 5 members using a Hedonic scale (Peryam and Pilgrim, 1957). It was taken based on the organoleptic scores given by panelists. Interpretation of the data was carried out in accordance with Panse and Sukhatme (1985).

Results and Discussion

Total soluble solids: Increasing trend of total soluble solids content was noticed during storage period presented table in table-1. The initial variation in TSS was found in different treatments which are attributed to processing variation. Significant difference was found in TSS of different recipes of jamun and guava blended juice. Among treatments the highest TSS recorded in T3 (10.07ºB) followed by T_1 (7.46ºB) and lowest was recorded in T_6 (5.91ºB) compared to all other treatments. This might be due to variation in composition of recipe. Increase of TSS during storage might be due to conversion of polysaccharides to simple sugars. Similar observations were reported by Tripathi *et al*. (1992) in pineapple and guava blended RTS beverage, Nidhi *et al*. (2008) in bael and guava beverage, Deka *et al*. (2005) in mango and pine apple spiced beverage and Sandhu and Sindhu (1992) in grape and mango blended RTS beverage.

pH: There was significant difference in pH among different days of storage period. During the storage period, the pH gradually increased from initial day to end of storage period. Among treatments the highest pH was recorded in treatment T_6 (3.66) followed by T_5 (2.93). This might be due to variation in composition of recipes. Significantly increase of pH during storage was attributed to the simultaneous decrease in titrable acidity of recipes.

Ascorbic acid: The data in the Fig. 1 revealed that, there was significant difference in ascorbic acid among different days of storage period. During the storage period, the ascorbic acid gradually decreased from initial day to end of the storage period. Among treatments with respect to the ascorbic acid and highest was recorded in treatment T_3 (17.89 mg/100 ml) followed by T_1 (17.57 mg/100 ml). This might be due to catalytic activity of enzymes. The loss of ascorbic acid during storage was probably due to the fact that ascorbic acid being sensitive to O_2, light and heat was easily oxidized in presence of O_2 by enzymatic and non-enzymatic catalysts (Map Son, 1970). Similar results were reported by Tripathi *et al*. (1992) in pineapple and guava RTS beverage, Attri *et al*. (1998) in pear and apple, apricot and plum blended RTS beverage, Deka (2000) in mango pineapple blended RTS beverage.

Total sugars: The data showed in the table-3 indicates that, there were significant differences among treatments with respect to the total sugars and highest was recorded in treatment T_1 (7.61) followed by T_2 (7.37) and lowest was recorded in T_6 (6.18). This might be due to the acid hydrolysis of polysaccharides to mono and oligosaccharides. Similar results have been reported by Attri *et al*. (1998) in pear and apple, apricot and plum blended RTS beverage, Sharma *et al*. (2001) in hill lemon RTS beverage and Ilamaran and

Table-1: Changes in total soluble (ºBrix) solids of jamun and guava juice blends as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	6.86	7.03	7.23	7.50	7.66	7.86	8.06	7.46^b
T_2	6.53	6.73	7.00	7.23	7.50	7.73	7.93	7.23^c
T_3	9.56	9.70	9.96	10.13	10.23	10.40	10.53	10.07^a
T_4	6.30	6.46	6.63	6.83	7.10	7.30	7.46	6.87^d
T_5	5.63	5.76	5.93	6.16	6.33	6.53	6.80	6.16^e
T6	5.26	5.46	5.66	5.93	6.16	6.36	6.56	5.91^f
Mean	6.69^g	6.86^f	7.07^e	7.30^d	7.50^c	7.70^b	7.89^a	
	F-test			S.Em±		CD at (0.05)		
For treatments (T)	**			0.027		0.076		
For days (D)	**			0.029		0.083		
For T × D	NS			0.072		-		

**significant at p = 0.01level of significance; NS---Non significant; Figures with same alphabet did not differ significantly

Table-2: Changes in pH of jamun and guava juice blends as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	3.43	3.45	3.48	3.51	3.54	3.56	3.59	3.51^d
T_2	3.52	3.54	3.57	3.61	3.64	3.66	3.69	3.60^c
T_3	3.54	3.56	3.58	3.62	3.65	3.67	3.70	3.62^{bc}
T_4	3.55	3.57	3.60	3.64	3.67	3.69	3.71	3.63^{ab}
T_5	2.85	2.87	2.90	2.93	2.96	2.99	3.01	2.93^e
T_6	3.58	3.61	3.64	3.66	3.69	3.72	3.75	3.66^a
Mean	3.41^f	3.43^{ef}	3.46^d	3.49^c	3.52^b	3.55^a	3.57^a	
	F-test			S.Em±		CD at (0.05)		
For treatments (T)	**			0.004		0.013		
For days (D)	**			0.005		0.014		
For T × D	NS			0.012		-		

**significant at p = 0.01level of significance; NS---Non significant; Figures with same alphabet did not differ significantly

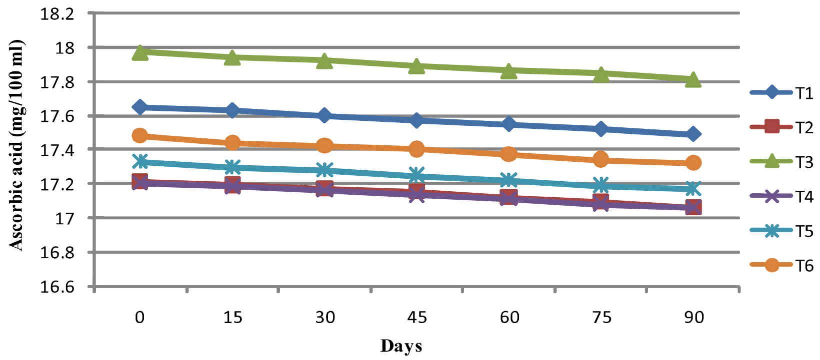

Fig. 1: Changes in ascorbic acid (mg/100 ml) of jamun and guava juice blends as influenced by different treatments during storage period

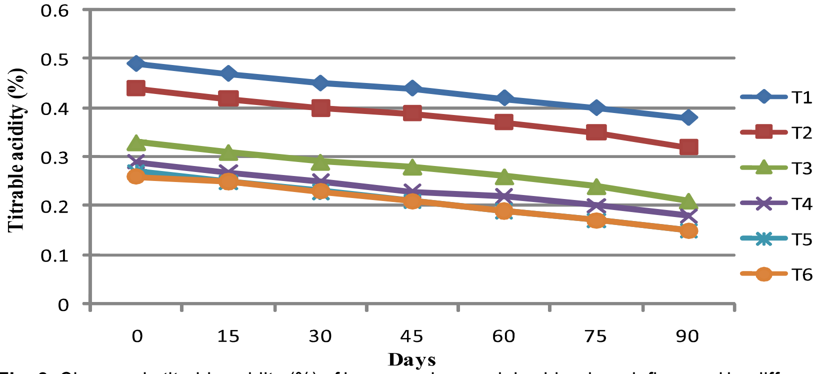

Fig. 2: Changes in titrable acidity (%) of jamun and guava juice blends as influenced by different treatments during storage period

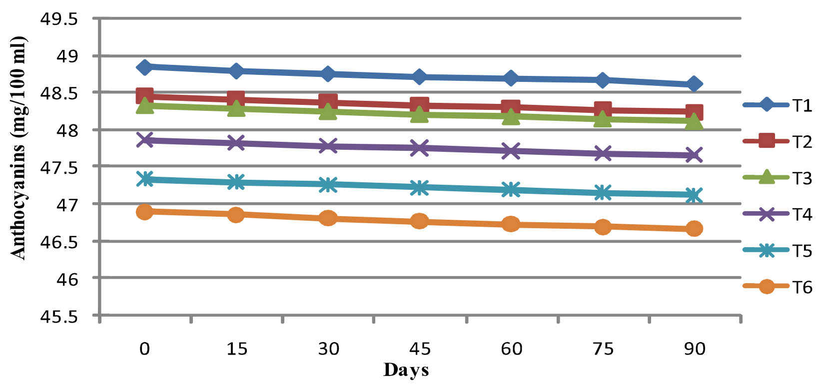

Fig. 3: Changes in anthocyanins (mg/100 ml) of jamun and guava juice blends as influenced by different treatments during storage period

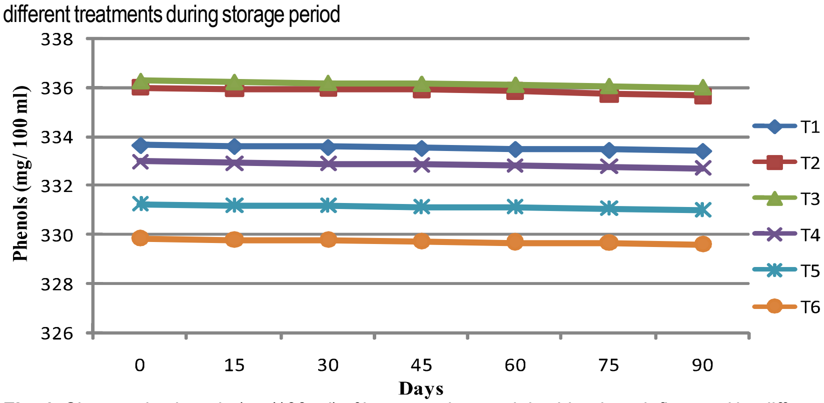

Fig. 4: Changes in phenols (mg/100 ml) of jamun and guava juice blends as influenced by different treatments during storage period

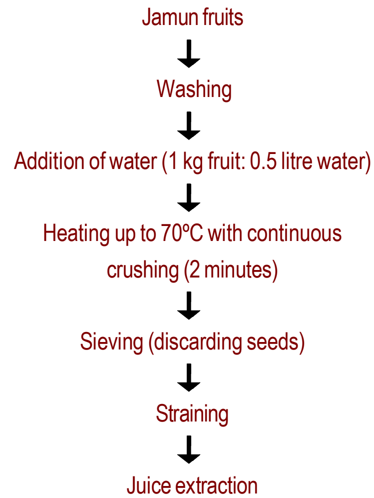

Fig. 5: Flow-chart for extraction of jamun juice

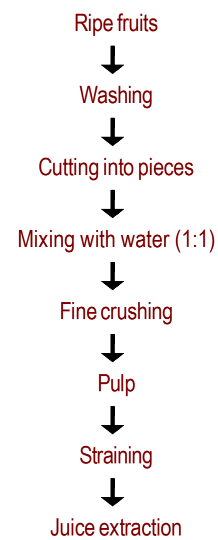

Fig. 6: Flow-chart for extraction of guava juice

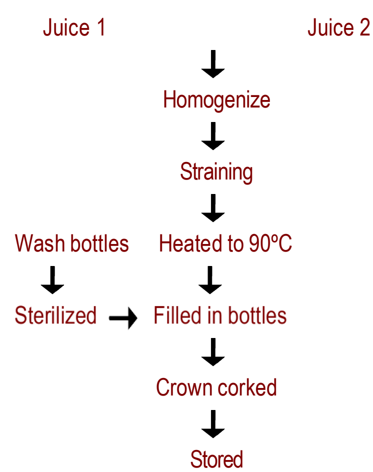

Fig. 7: Flow-chart for preparation of juice blend

Table-3: Changes in total sugars (%) of jamun and guava juice blends as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	7.28	7.30	7.34	7.37	7.40	7.43	7.45	7.37[b]
T_2	6.93	6.95	6.99	7.02	7.05	7.07	7.09	7.02[c]
T_3	7.51	7.55	7.58	7.61	7.64	7.67	7.69	7.61[a]
T_4	6.39	6.41	6.44	6.48	6.51	6.53	6.55	6.47[d]
T_5	6.18	6.21	6.24	6.27	6.32	6.34	6.36	6.27[e]
T_6	6.09	6.12	6.15	6.19	6.22	6.24	6.26	6.18[f]
Mean	6.73[ef]	6.76[def]	6.79[de]	6.82[bcd]	6.86[abc]	6.88[ab]	6.90[a]	
		F-test		S.Em±		CD at (0.05)		
For treatments (T)		**		0.017		0.049		
For days (D)		**		0.018		0.053		
For T × D		NS		0.046		-		

**significant at p = 0.01level of significance; NS---Non significant; Figures with same alphabet did not differ significantly

Table-4: Changes in microbial count (cfu/ml) of jamun and guava juice blends as influenced by different treatments during storage period

Treatments	(No. × 10^5 CFU/ml)		
	Initial	90 DAS	Mean
T_1	2.33	2.88	2.60[b]
T_2	2.38	2.93	2.65[c]
T_3	2.21	2.76	2.48[a]
T_4	2.43	2.98	2.70[d]
T_5	2.46	3.01	2.73[e]
T_6	2.49	3.04	2.76[f]
Mean	2.38[a]	2.93[b]	
	F-test	S.Em±	CD at (0.05)
For treatments (T)	**	0.006	0.017
For days (D)	**	0.003	0.010
For T × D	NS	0.008	

**significant at p = 0.01level of significance; NS---Non significant; Figures with same alphabet did not differ significantly

Amutha (2007) in banana and sapota beverages and Waskar (2003) in pomegranate and kokum blended juice.

Titrable acidity: The titrable acidity represented in Fig. 2 recorded significant differences among treatments with respect to titrable acidity and highest was recorded in treatment T_1 (0.43) followed by T_2 (0.38) and lowest was recorded in T_5 (0.21). During the storage period, the titrable acidity gradually decreased from initial day to end of storage period might be due to conversion of acids into salts and sugars by enzymes particularly invertase. Similar observations were noticed by Gajanana (2002), Deka (2000) in lime-aonla, mango-pineapple, guava-mango blends, Tiwari (2000) in guava and papaya blended RTS, and Dhaliwal and Hira (2001) in carrot juice blends.

Anthocyanins: The anthocyanin content gradually decreased during the storage period among treatments with respect to anthocyanins and highest was recorded in treatment T_1 (48.72 mg/ 100 ml) followed by T_2 (48.34 mg/100 ml) and lowest was recorded in T_6 (46.77 mg/100 ml). This might be due to slow degradation of anthocyanins, which maintained stability compared to other treatments, where different ratios of jamun and guava juice blends.

Table-5: Changes in organoleptic characteristics at 90 days of storage of jamun and guava juice blends as influenced by different treatments

Treatments	Appearance	Aroma and flavour	Taste	Overall acceptability
T_1	4.23[ab]	4.26[bc]	4.26[b]	4.36[b]
T_2	4.12[b]	4.23[c]	4.24[b]	4.23[c]
T_3	4.26[a]	4.33[a]	4.34[a]	4.46[a]
T_4	3.84[c]	3.76[d]	3.82[c]	3.81[d]
T_5	3.69[d]	3.37[e]	3.72[d]	3.74[e]
T_6	3.65[d]	3.29[f]	3.58[e]	3.41[f]
F-test	**	**	**	**
S. Em±	0.035	0.020	0.029	0.006
CD at (0.05)	0.108	0.063	0.089	0.019

**significant at p = 0.01level of significance; NS---Non significant; Figures with same alphabet did not differ significantly

Moreover, several factors are believed to affect the stability of anthocynin in fruits and vegetables during preparation, processing and storage which include pH, temperature, light, oxygen, metal, ions, enzymes and sugars. Anthocyanins were decreased during storage, this might be due to the hydrolysis of anthocyanins at higher temperature for longer time (Rhim, 2002). As per Cemeoglus et al. (1994) and Rhim (2002) the extent of thermal degradation of anthocyanins was increased with higher soluble solid content whereas lower pH generally gave better thermal stability (Mok and Hethiarachachy, 1991).

Total phenols: There were significant differences among treatments with respect to total phenols and highest was recorded in treatment T_3 (336.14 mg/100 ml) followed by T_2 (335.85 mg/100 ml).) and lowest was recorded in T_6 (329.71 mg/100 ml). The decrease in phenols during storage of jamun and guava juice blends might be due to their oxidation and condensation into brown pigments. Similar pattern was observed by Sarolia and Mukherjee (2002) in lime juice and Upale (2005) in storage of jamun juice.

Microbial count*:* There was significant difference in microbial count among different days of storage period. During the storage period, the microbial count gradually increased from initial day to end of storage period. There was significant difference in microbial count among different days of storage period. During the storage period, the microbial count gradually increased from initial day to end of storage period. Significantly lowest microbial count was recorded at initial day (2.38 cfu/ml) and a highest microbial count was recorded during 90 days of (2.93 cfu/ml) storage period. It was found to increase marginally during the storage period upto three months storage. But, such marginal increase did not affect the product.

Sensory evaluation: There were significant differences among treatments with respect to appearance, aroma and flavour, taste and overall acceptability and highest was recorded in T_3 respectively (4.26), (4.33), (4.34), (4.46). Based on the organoleptic evaluation the treatment T_3 has scored highest acceptability compared to the other treatments, which might be due to the appropriate maintenance of all chemical constituents, better consistency, sugar acid ratios and lowest microbial count.

Shelf life (Days): Shelf life of the treatment was considered based on the scores obtained during organoleptic evaluation by panelists.

As the overall acceptability of the all treatments is more than 3, they were fairly acceptable at 90 days of storage period. However, treatment T_3 - 80 % Jamun juice + 20 % Guava juice + 500 ppm Sodium benzoate scored highest acceptability and was evaluated as best treatments. Further, investigation is required to know the exact days of shelf life as influenced by the treatments.

Jamun and guava juices blended in ratio 80:20 with 500ppm sodium benzoate has recorded more acceptable quality blend. Taking into consideration of the health benefits of jamun juice, the future research should be carried out further on different products of jamun. From the present work, jamun juice and its blends were investigated up to 90 days and it should be carried for further period to know the exact storability of treatments. Moreover, this study with best treatment can also be conducted under different storage conditions like cold storage to analysis the shelf life of treatments for longer period. Jamun which is a seasonal fruits with best nutritional and health benefits can be relished for longer period of time.

Acknowledgements

The authors would like to thank the full support provided by College of Horticulture, Mojerla, Mahabubnagar, Dr.Y.S.R. Horticultural university Andhrapradesh.

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