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Influence of Different Storage Techniques on Quality and Shelf Life of Jamun Juice

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ABSTRACT

An experiment was conducted to investigate the quality and storage life of jamun juice in pasteurized and preservative form at ambient conditions during 2013-2014 in postharvest technology laboratory at College of Horticulture, Mojerla, Mahabubnagar District, Telangana State. The investigation comprised of five treatments i.e. jamun juice + 350 ppm sodium benzoate (T_1), jamun juice + 500 ppm sodium benzoate (T_2), pasteurization of jamun juice (at a temperature of 80 ± 5° C) (T_3), pasteurization of jamun juice (at a temperature of 80 ± 5° C) + 350 ppm sodium benzoate (T_4), pasteurization of jamun juice (at a temperature of 80 ± 5° C) + 500 ppm sodium benzoate (T_5) 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_5 (4.36). Among the treatments the highest total sugars was observed in T_5 (7.59) and lowest in T_3 (6.83). The highest anthocyanin content was recorded in T_5 (48.65) and lowest in T_3 (47.97). Whereas, the lowest microbial content was observed in T_5 (2.78) and highest in T_3 (3.42).

Key words: *Jamun juice, Titrable acidity, Sodium benzoate, 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[1].

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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[7]. 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[4] and against bleeding piles, correcting liver disorders, jaundice, kidney stone, asthma, blood pressure[6].

Jamun fruits are not only used for table purpose, but also used in processing, considering the unique blend of taste and nutrition of fruits. It could not be utilized for proper consumption or processed due to lack of processing techniques and technical knowhow. Jamun being a highly perishable with short shelf life of fruit, it deteriorates at very faster rate, if proper post-harvest handling practices and processing techniques are not adopted. The storage life of jamun fruit is restricted to only 24 hrs at room temperature and 12 days at 3 to 4°C and 85 to 95 per cent relative humidity[11].

Since it is highly perishable, it has very short storage life and marketing of its fresh fruits to distant places is very difficult. Therefore, attempt has been made in this study to preserve jamun in the form of juice by adopting different storage techniques.

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.

In case of T_1 (Jamun juice + 350 ppm Sodium benzoate) and T_2 (Jamun juice + 500 ppm Sodium benzoate), 350 ppm and 500 ppm of sodium benzoate was added respectively to the heated juice. In T_3 jamun juice was pasteurized at a temperature of 80 ± 5°C, without adding the preservative, and then filled into sterilized bottles. In treatment T_4 and T_5 jamun juice was pasteurization at a temperature of 80 ± 5°C for 10 minutes, cooled and added with 350 ppm 500 ppm sodium benzoate respectively. After imposition of treatments, the juices 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 conditions for further evaluation.

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[12]. Anthocyanins were estimated by adopting the procedure bisulphate bleaching method and phenols as per the Folin Ciocalteau Reagent method by Bray and Thorpe[2]. For estimating the microbial population in different sample products, dilution plate method was followed by Cruick Shank *et al*[3]. Organoleptic evaluation was done by a panel of 5 members using a Hedonic scale by Peryam and Pilgrim[10]. It was taken based on the organoleptic scores given by panelists. Interpretation of the data was carried out in accordance with Panse and Sukhatme[9].

RESULTS AND DISCUSSION

Total soluble solids:

Increasing trend of total soluble solids content was noticed during storage period presented table in Table 1. The highest total soluble solids were observed in T_5 (9.14). The increase in TSS of jamun juice during storage period might be due to slow hydrolysis of

polysaccharides, acids and pectin substances to simple substances like sugars. Similar results have been reported by Madan lal choudary *et al*[8]., in guava 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 the treatments the highest pH was recorded in T_5 (3.95) followed by T_4 (3.69). Significant increase of pH during storage could be attributed to the simultaneous decrease in titrable acidity of juice (Table 2).

Ascorbic acid:

The data in the Fig. 1 revealed that, there were significant differences among treatments with respect to the ascorbic acid, the highest ascorbic acid was recorded in treatment T_5 (17.36) followed by T_4 (16.64). This is might be due to thermal degradation during processing and subsequent oxidation effect of light and storage temperature. Degradation of ascorbic acid into dehydro ascorbic acid furfural and hydroxyl furfural is a common phenomena observed during storage. Similar decline in ascorbic acid have been reported by Upale[16] in storage of jamun juice.

Total sugars:

The data showed in the table 3 indicates that, there were significant differences among treatments with respect to the changes in total sugars of jamun juice, the highest total sugars was recorded in treatment, T_5 (7.59) followed by T_4 (7.37) and the lowest was recorded in T_3 (6.83). This might be attributed to slow hydrolysis of polysaccharides, acids and pectin substances to simple substances like reducing and non reducing sugars and from the present investigation, the increase in total sugars content coincided with the increase in Total Soluble Solids.

Titrable acidity:

The titrable acidity represented in Fig. 2 recorded significant differences among treatments, the highest titrable acidity was recorded in treatment T_4 (0.29) followed by T_5 (0.25). The decrease in titrable acidity content during storage period, might be due to conversion of acids into salts and sugars by enzymes particularly invertase. Gajanana[5] reported that decrease in titrable acidity content during storage period might be due to acid hydrolysis of polysaccharides in amla juice.

Anthocyanins:

The anthocyanin acidity represented in Fig. 3 anthocyanin content gradually decreased during the storage period and among the treatments the anthocyanins in jamun juice registered significant results and the highest anthocyanins content was recorded in treatment T_5 (48.65) followed by T_4 (48.32) and lowest in T_3 (47.97). The decrease in anthocyanin content during storage of jamun juice might be due to hydrolysis of protopective 3-glucoside linkage of anthocyanins. These results were conformity with that reports given Upale[16] in storage of jamun juice.

Total phenols:

There were significant differences among treatments with respect to total phenols and highest phenols was recorded in treatment T_5 (335.94). The decrease in phenols during storage of jamun juice might be due to their oxidation and condensation into brown pigments. Analogous results were reported by Sarolia and Mukherjee[14] in lime juice and Upale[16] in storage of jamun juice (Table 4).

Microbial count:

The data showed in the table 5 indicates that 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. The significantly lowest microbial counts were recorded at initial day (2.77) while highest at 90 days (3.35) of storage. The microbial population in jamun juice during storage was very low at the beginning of storage. It was found to increase marginally during the storage period up to three months storage. But, such marginal increase did not affect the product. This may be attributed to the effect of both heat treatment and chemical preservatives in checking the growth of microorganisms. These

results were accordance with Sowjanya[15] in pomegranate juice.

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_5 respectively (4.17), (4.33), (4.26), (4.36). Based on the organoleptic evaluation the treatment T_5 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 (Table 6).

Shelf life (Days):

The scores for overall acceptability of treatment T_3 - Pasteurization of jamun juice (at a temperature of 80 ± 5°C) was poorly acceptable compared to other treatments which scored more than 4. The treatment T_3 terminated by 90 days of storage and other treatments are acceptable at that stage. However, the T_5 has recorded highest acceptability and was considered as best treatment for storage of jamun juice for longer period of time.

Table 1: Changes in total soluble solids (°Brix) of jamun juice as influenced by different treatment during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	8.45	8.60	8.70	8.85	8.92	9.10	9.17	8.82^{c}
T_2	8.52	8.62	8.82	8.92	9.10	9.20	9.30	8.92^{bc}
T_3	8.32	8.47	8.60	8.77	8.77	8.90	8.97	8.68^{d}
T_4	8.70	8.85	8.97	9.10	9.20	9.35	9.42	9.08^{a}
T_5	8.87	8.87	9.0	9.15	9.27	9.37	9.47	9.14^{a}
Mean	8.57^{f}	8.68^{ef}	8.82^{de}	8.96^{cd}	9.05^{bc}	9.19^{ab}	9.27^{a}	

F-test		S.Em±	CD at (0.05)
For treatments (T)	**	0.043	0.123
For days (D)	**	0.520	0.145
For D × T	NS	0.116	-

**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 juice as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	3.49	3.52	3.56	3.60	3.63	3.67	3.71	3.60^{c}
T_2	3.58	362	3.65	3.68	3.72	3.76	3.80	3.69^{b}
T_3	3.43	3.47	3.50	353	3.57	3.61	3.64	3.53^{d}
T_4	3.59	3.62	3.66	3.69	3.73	3.77	3.81	3.69^{b}
T_5	3.54	3.86	3.91	3.94	3.99	4.03	4.07	3.95^{a}
Mean	3.59^{g}	3.26^{f}	3.65^{e}	3.69^{d}	3.73^{c}	3.77^{b}	3.81^{a}	

F-test		S.Em±	CD at (0.05)
For treatments (T)	**	0.005	0.016
For days (D)	**	0.006	0.018
For D × T	NS	0.015	-

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

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

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	6.57	6.75	7.00	7.25	7.45	7.65	7.87	7.22^{c}
T_2	6.67	6.90	7.12	7.35	7.55	7.72	8.00	7.33^{b}
T_3	6.17	6.37	6.62	6.82	7.07	7.27	7.50	6.83^{d}
T_4	6.65	6.90	7.15	7.40	7.62	7.85	8.05	7.37^{b}
T_5	6.92	7.17	7.37	7.62	7.82	8.05	8.15	7.59^{a}
Mean	6.60^{g}	6.82^{f}	7.05^{e}	7.29^{d}	7.50^{c}	7.71^{b}	7.91^{a}	

F-test		S.Em±	CD at (0.05)
For treatments (T)	**	0.032	0.091
For days (D)	**	0.038	0.108
For D × T	NS	0.086	-

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

Table 4: Changes in phenols (mg/100 ml) of jamun juice as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	336.07	335.98	335.90	335.79	335.71	335.62	335.54	335.80^{c}
T_2	336.09	335.99	335.91	335.84	335.75	335.68	335.60	335.83^{bc}
T_3	334.02	333.93	333.86	333.78	333.70	333.62	333.54	333.78^{d}
T_4	336.15	336.07	335.98	335.90	335.83	335.76	335.68	335.91^{a}
T_5	336.19	336.10	336.02	335.95	335.87	335.78	335.70	335.94^{a}
Mean	335.70^{a}	335.62^{b}	335.53^{c}	335.45^{d}	335.37^{e}	335.29^{f}	335.21^{g}	

F-test		S.Em±	CD at (0.05)
For treatments (T)	**	0.010	0.029
For days (D)	**	0.012	0.034
For D × T	NS	0.027	-

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

Table 5: Changes in microbial count (cfu/ml) of jamun juice as influenced by different treatments during storage period

Treatments	(No. × 10^5 CFU/ml)		
	Initial	90 DAS	Mean
T_1	2.94	3.39	3.17^{d}
T_2	2.85	3.30	3.07^{c}
T_3	2.86	3.98	3.42^{e}
T_4	2.64	3.09	2.86^{b}
T_5	2.56	3.01	2.78^{a}
Mean	2.77^{a}	3.35^{b}	

F-test		S.Em±	CD at (0.05)
For treatments (T)	**	0.006	0.019
For days (D)	**	0.004	0.012
For T × D	NS	0.009	

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

Table 6: Changes in organoleptic characteristics at 90 days of storage of jamun juice as influenced by different treatments

Treatments	Appearance	Aroma and flavour	Taste	Overall acceptability
T_1	3.25^{c}	3.37^{c}	3.89^{c}	4.04^{c}
T_2	3.47^{b}	4.09^{ab}	3.97^{bc}	4.09^{c}
T_3	2.05^{d}	2.15^{d}	2.10^{d}	2.47^{d}
T_4	3.67^{b}	4.23^{ab}	4.10^{ab}	4.23^{b}
T_5	4.17^{a}	4.33^{a}	4.26^{a}	4.36^{a}
F-test	**	**	**	**
S. Em±	0.071	0.102	0.078	0.034
CD at (0.05)	0.216	0.309	0.238	0.104

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

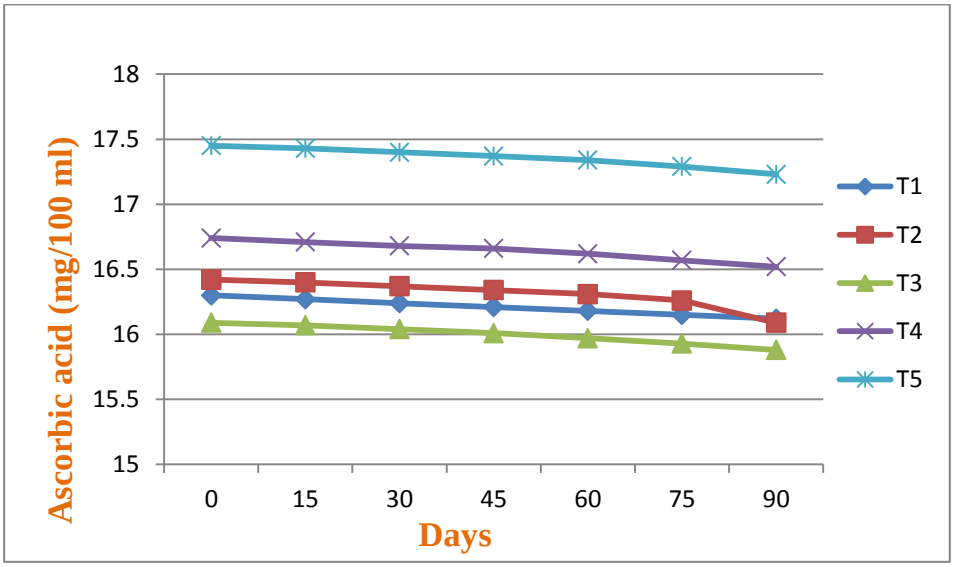

Fig. 1: Changes in ascorbic acid (mg/100 ml) of jamun juice as influenced by different treatments during storage period

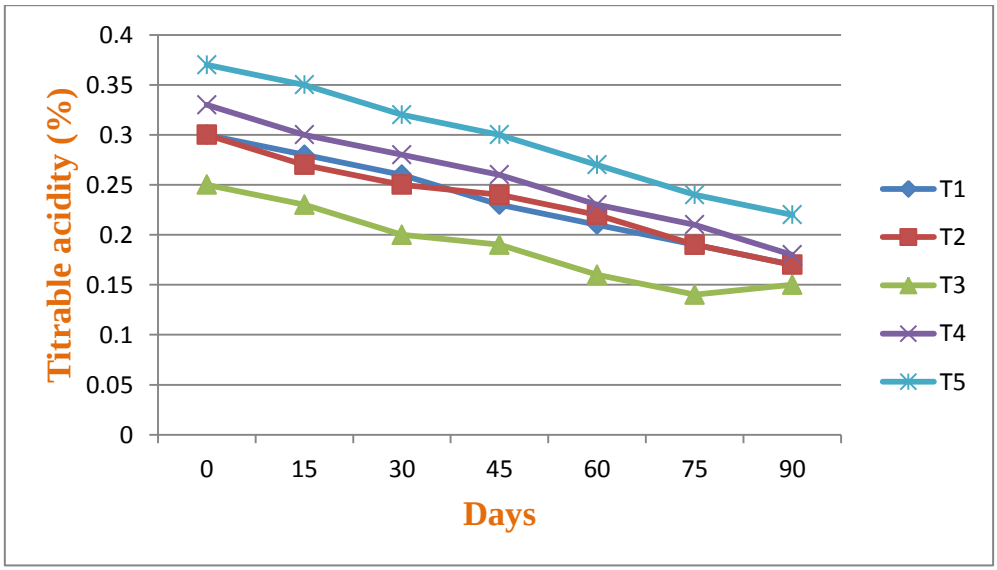

Fig. 2: Changes in titrable acidity (%) of jamun juice as influenced by different treatments during storage period

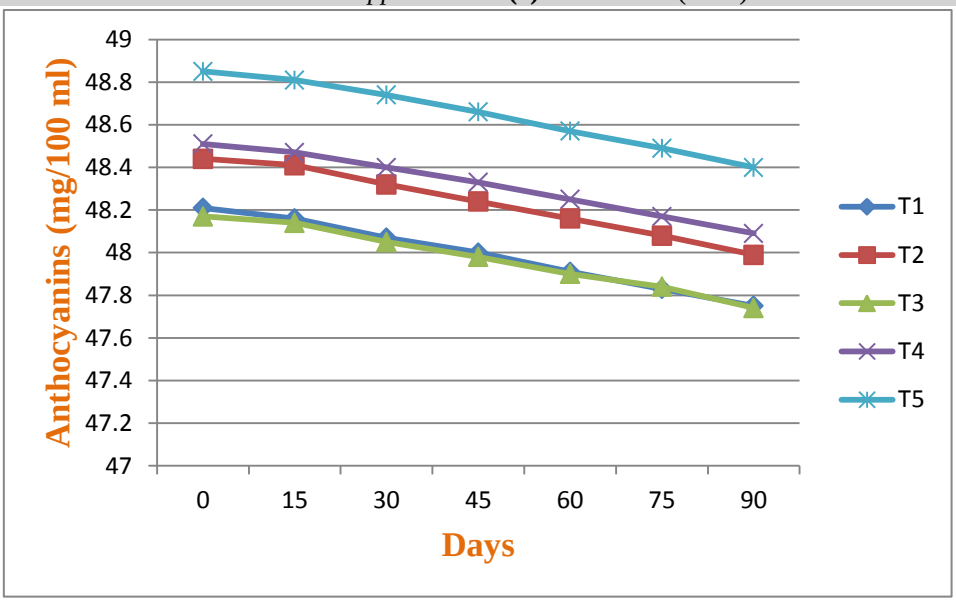

Fig. 3:Changes in anthocyanins (mg/100 ml) of jamun juice as influenced by different treatments during storage period

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