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Sensory Quality and Storage of Jamun Juice as Effected by Blending with Pomegranate Juice

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ABSTRACT

An experiment was conducted to investigate sensory quality and storage of jamun juice blended with pomegranate 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 % Pomegranate juice + 500 ppm Sodium benzoate (T_2), 80 % Jamun juice + 20 % Pomegranate juice + 500 ppm Sodium benzoate (T_3), 70 % Jamun juice + 30 % Pomegranate juice + 500 ppm Sodium benzoate (T_4), 60 % Jamun juice + 40 % Pomegranate juice + 500 ppm Sodium benzoate (T_5), 50 % Jamun juice + 50 % Pomegranate 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_2 (4.47). Among the treatments the highest total sugars was observed in T_1 (8.78) and lowest in T_4 (8.60). The highest anthocyanin content was recorded in T_1 (49.32) and lowest in T_6 (45.82). Whereas, the lowest microbial content was observed in T_2 (2.22) and highest in T_5 (2.47).

Key words: *Jamun juice, Pomegranate juice, 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[10]. 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[6] and against bleeding piles, correcting liver disorders, jaundice, kidney stone, asthma, blood pressure[9].

Pomegranate (*Punica granatum* L.), belonging to the family Punicaceae is one of the favorite exotic fruits which is grown all over India. The products of pomegranate such as bottled juice, syrup and jelly are appreciated due to its nutritive and dessert qualities and palatability[18].

The arils or juice of pomegranate contains mainly high sugar content, dietary fibre and variable quantity of organic acids. In addition, pomegranate has been reported to be rich source of vitamins like foliate and vitamin K[17]. Fruit astringent properties have been used to treat various ailments (cuts, sore throats, tapeworms, dysentery, and gum disease). Pomegranate juice is a major source of antioxidant nutrients that protect against heart disease. Recent research has focused on its potential use as a treatment for cardiovascular disease, diabetes and various forms of cancer.

Gil *et al*[8]., reported that pomegranate juice has become popular worldwide. Numerous studies on antioxidant activity have shown that pomegranate juice contains higher levels of antioxidants than most fruit juices. Pomegranate juice has potential anti-atherogenic effects in healthy humans and atherosclerotic effects in mice along with other nutritional and health advantages[3]. Due to the nutritive and pharmaceutical properties of pomegranate and jamun juice, the blends of both juices in different proportions will have appreciable impact on organoleptic properties.

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.

Pomegranate fruits were collected from orchards located at Gadwal, Mahabubnagar District. The pomegranate fruits brought for the experiment were washed thoroughly before the extraction of juice. Fruits were cut into four pieces opened using a knife discarding the peel adhering to the placenta and the arils were carefully separated. The arils so separated were crushed in a grinder and filtered through muslin cloth to extract the juice.

In case of treatment T_1 (100 % Jamun juice), only jamun juice was preserved and added with 500 ppm sodium benzoate. In case of T_2 to T_6, the jamun juice of 90 %, 80 %, 70 %, 60 % and 50 % was taken and mixed with pomegranate juice at 10 %, 20 %, 30 %, 40 % and 50 % respectively. All these treatments were added with 500 ppm sodium benzoate as preservative. After preparation of juice blends they 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 study.

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[13]. Anthocyanins were estimated by adopting the

procedure bisulphate bleaching method and phenols as per the Folin Ciocalteau Reagent method[4]. For estimating the microbial population in different sample products, dilution plate method was followed[5]. Organoleptic evaluation was done by a panel of 5 members using a Hedonic scale[12]. It was taken based on the organoleptic scores given by panelists. Interpretation of the data was carried out in accordance with Panse and Sukhatme[11].

RESULTS AND DISCUSSION

Total soluble solids:

The data showed in the table 1 indicates that there were significant differences among treatments with respect to the TSS and highest was recorded in treatment T_2 (12.55ºB) followed by T_3 (11.92ºB) and lowest was recorded in T_5 (10.21ºB) compared to all other treatments. During the storage period, the TSS gradually increased from initial day to end of storage period. The variation in TSS was found in different treatments which were attributed to processing variation. This might be due to variation in composition of recipe. Increase of TSS during storage could be due to conversion of polysaccharides to simple sugars.

pH:

There was significant difference in pH among different days of storage period. During the storage period, the pH gradually decreased from initial day to end of storage period. Among treatments the highest pH was recorded in treatment T_2 **(**3.85) followed by T_1 (3.67) and lowest was recorded in T_5 (3.47). Among blends significantly higher pH was found in treatment, T_2 might be due to more clarity in composition appearance of recipe compared to other treatments. Significant increase of pH during storage could be attributed to the simultaneous decrease in titrable acidity (Table 2).

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_2 (17.44 mg/100 ml) followed by T_1 (16.96 mg/100 ml). Among blends significantly higher ascorbic acid content was observed in treatment T_2 might be due to catalyze activity of enzymes. The loss of ascorbic acid during storage period might be due to oxidation by trapped oxygen in glass bottles.

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 (8.78) followed by T_2 (8.74) and lowest was recorded in T_4 (8.60). . During the storage period, the total sugars gradually increased from initial day to end of storage period. This might be due to higher levels of Total Soluble Solids content and total sugars were increased during storage, this might be due to hydrolysis of starch into simple sugars, Attri *et al*[1].

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_6 (0.38) followed by $T_{0.33}$ (0.38) and lowest was recorded in T_1 (0.27). 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[7].

Anthocyanins:

The anthocyanin acidity represented in Fig 3 the anthocyanin content gradually decreased during the storage period among treatments with respect to anthocyanins and highest was recorded in treatment T_1 (49.32 mg/100 ml) followed by T_2 (49.13 mg/100 ml) and lowest was recorded in T_6 (45.82 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 pomegranate juice blends.

Anthocyanins were decreased during storage, this might be due to the hydrolysis of anthocyanins at higher temperature, Rhim[14].

Total phenols:

There were significant differences among treatments with respect to total phenols and highest was recorded in treatment T_2 (336.24 mg/100 ml) followed by T_1 (336.11 mg/100 ml).) and lowest was recorded in T_5 (333.09 mg/100 ml). The highest phenols were observed in treatment, T_2 might be due to best blend of composition of juice compared to other recipes. 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[15] in lime juice and Upale[16] in storage of jamun juice (Fig 4).

Microbial count:

The data showed in the table 4 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. 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 (2.12 cfu/ml) and a highest microbial count was recorded during 90 days of (2.61 cfu/ml) storage period. It was found to increase marginally during the storage period up to 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 (4.38), (4.36), (4.46), (4.47). Based on the organoleptic evaluation the treatment T_2 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 5).

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_2 - 90 % Jamun juice + 10 % Pomegranate 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.

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

Treatments	Days after storage							Mean
	0	15	30	45	60	75	90	
T_1	9.73	10.00	10.26	10.50	10.76	11.06	11.26	10.51^{d}
T_2	11.80	12.03	13.30	12.56	12.80	13.06	13.30	12.55^{a}
T_3	11.23	11.46	11.70	11.93	12.13	12.40	12.63	11.92^{b}
T_4	11.13	11.40	11.63	11.86	12.10	12.33	12.53	11.85^{b}
T_5	9.60	9.63	10.00	10.26	10.50	10.70	10.86	10.22^{e}
T_6	9.93	10.20	10.46	1.070	10.93	11.23	11.40	10.69^{c}
Mean	10.57^{g}	10.78^{f}	11.06^{e}	11.30^{d}	11.53^{c}	11.80^{b}	12.00^{a}	

	F-test	S.Em±	CD at (0.05)
For treatments (T)	**	0.038	0.107
For days (D)	**	0.041	0.115
For T × D	NS	0.100	-

**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 pomegranate juice blends as influenced by different treatments during storage period

Treatments	Days after storage							Mean
	0	**15**	**30**	**45**	**60**	**75**	**90**	
T_1	3.59	3.62	3.65	3.67	3.70	3.72	3.74	3.67^{b}
T_2	3.77	3.80	3.83	3.86	3.88	3.90	3.92	3.85^{a}
T_3	3.56	3.59	3.62	3.64	3.67	3.69	3.71	3.64^{c}
T_4	3.48	3.50	3.53	3.55	3.58	3.60	3.62	3.55^{d}
T_5	3.40	3.43	3.46	3.48	3.50	3.52	3.55	3.47^{f}
T_6	3.45	3.48	3.51	3.54	3.57	3.59	3.61	3.53^{e}
Mean	3.54^{g}	3.57^{f}	3.60^{e}	3.62^{d}	3.65^{c}	3.67^{b}	3.69^{a}	

F-test	**S.Em±**	**CD at (0.05)**
For treatments (T)	**	0.003	0.009
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

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

Treatments	Days after storage							Mean
	0	**15**	**30**	**45**	**60**	**75**	**90**	
T_1	8.70	8.73	8.75	8.78	8.81	8.84	8.86	8.78^{a}
T_2	8.66	8.69	8.72	8.75	8.77	8.80	8.82	8.74^{b}
T_3	8.64	8.67	8.70	8.73	8.75	8.78	8.80	8.72^{c}
T_4	8.52	8.55	8.58	8.61	8.64	8.66	8.68	8.60^{f}
T_5	8.56	8.58	8.61	8.64	8.66	8.69	8.71	8.63^{e}
T_6	8.57	8.59	8.62	8.65	8.68	8.70	8.72	8.65^{d}
Mean	8.60^{g}	8.63^{f}	8.66^{e}	8.69^{d}	8.72^{c}	8.74^{b}	8.76^{a}	

F-test	**S.Em±**	**CD at (0.05)**
For treatments (T)	**	0.003	0.009
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

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

Treatments	(No. × 10^5 CFU/ml)		
	Initial	90 DAS	Mean
T_1	2.07	2.60	2.33^{b}
T_2	2.08	2.37	2.22^{a}
T_3	2.08	2.61	2.35^{b}
T_4	2.12	2.64	2.38^{c}
T_5	2.21	2.74	2.47^{e}
T_6	2.18	2.71	2.44^{d}
Mean	2.12^{a}	2.61^{b}	

F-test	**S.Em±**	**CD at (0.05)**
For treatments (T)	**	0.009	0.027
For days (D)	**	0.005	0.015
For T × D	NS	0.013	

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

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

Treatments	Appearance	Aroma and flavour	Taste	Overall acceptability
T_1	4.26^b	4.26^b	4.37^b	4.35^b
T_2	4.38^a	4.36^a	4.46^a	4.47^a
T_3	3.88^c	4.02^c	4.15^c	4.14^c
T_4	3.83^d	3.88^d	3.91^d	3.95^d
T_5	3.76^e	3.85^e	3.81^e	3.85^e
T_6	3.64^f	3.74^f	3.67^f	3.75^f
F-test	**	**	**	**
S. Em±	0.010	0.007	0.009	0.006
CD at (0.05)	0.030	0.022	0.028	0.019

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

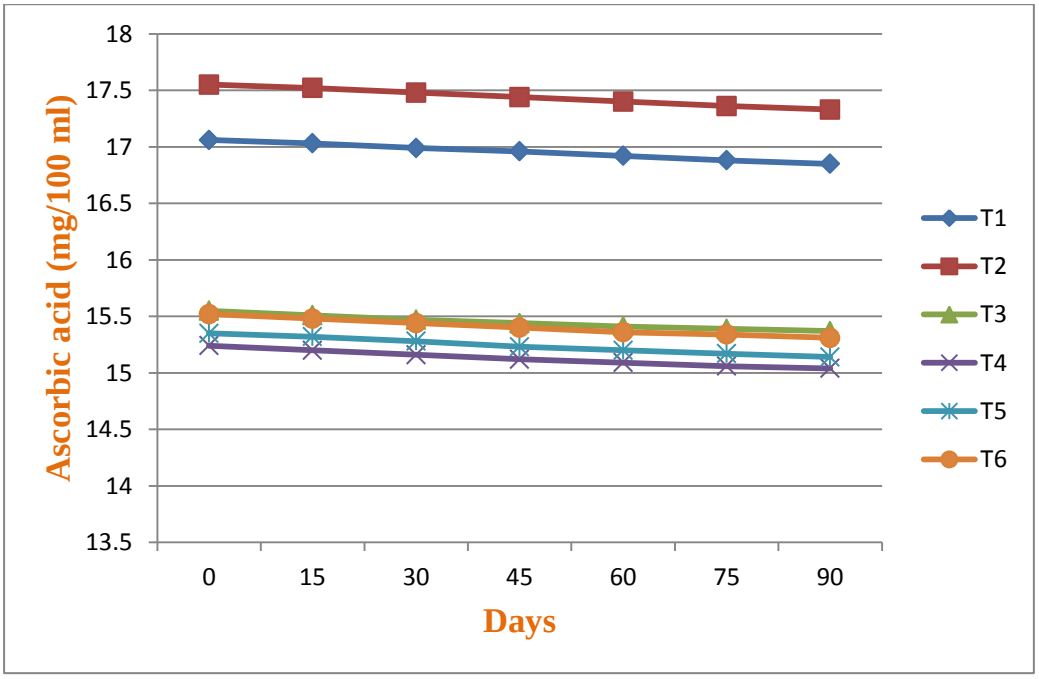

Fig. 1: Changes in ascorbic acid (mg/100 ml) of jamun and pomegranate juice blends as influenced by different treatments during storage period

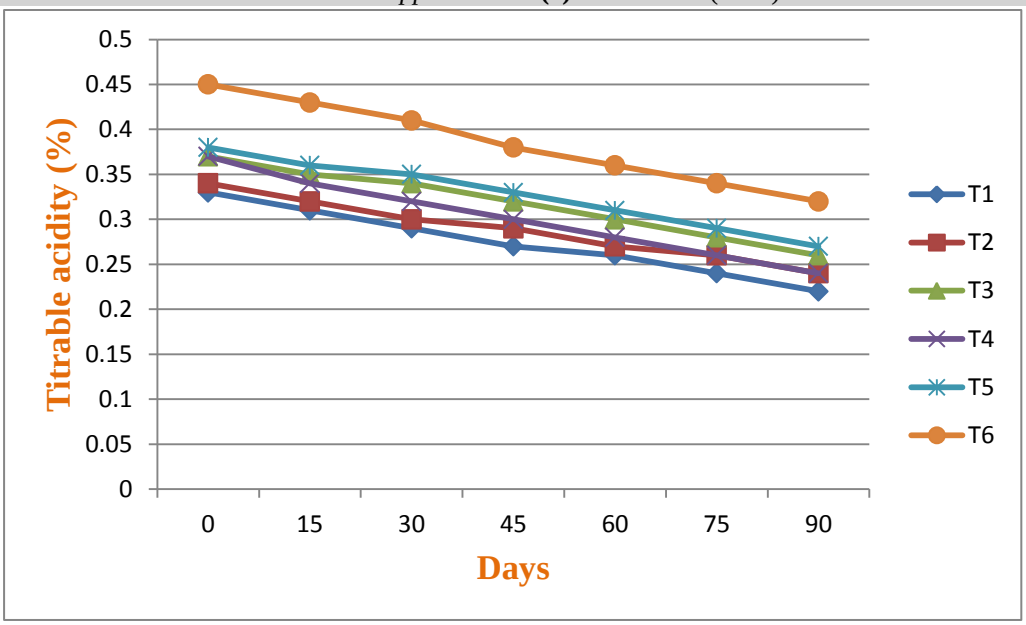

Fig. 2: Changes in titrable acidity (%) of jamun and pomegranate juice blends as influenced by different treatments during storage period

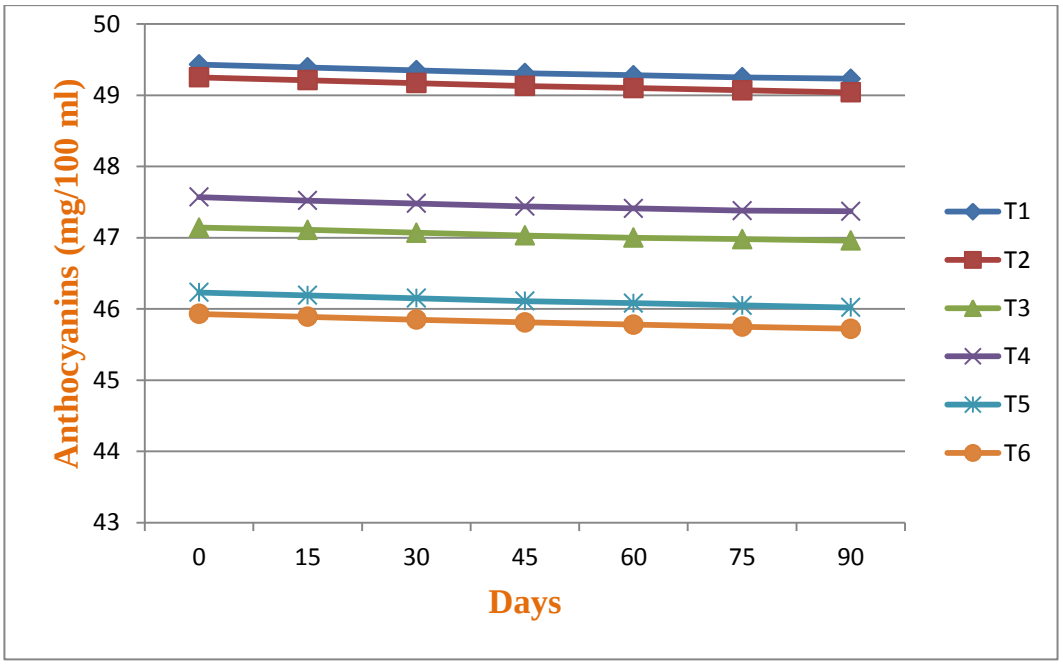

Fig. 3: Changes in anthocyanins (mg/100 ml) of jamun and pomegranate juice blends as influenced by different treatments during storage period

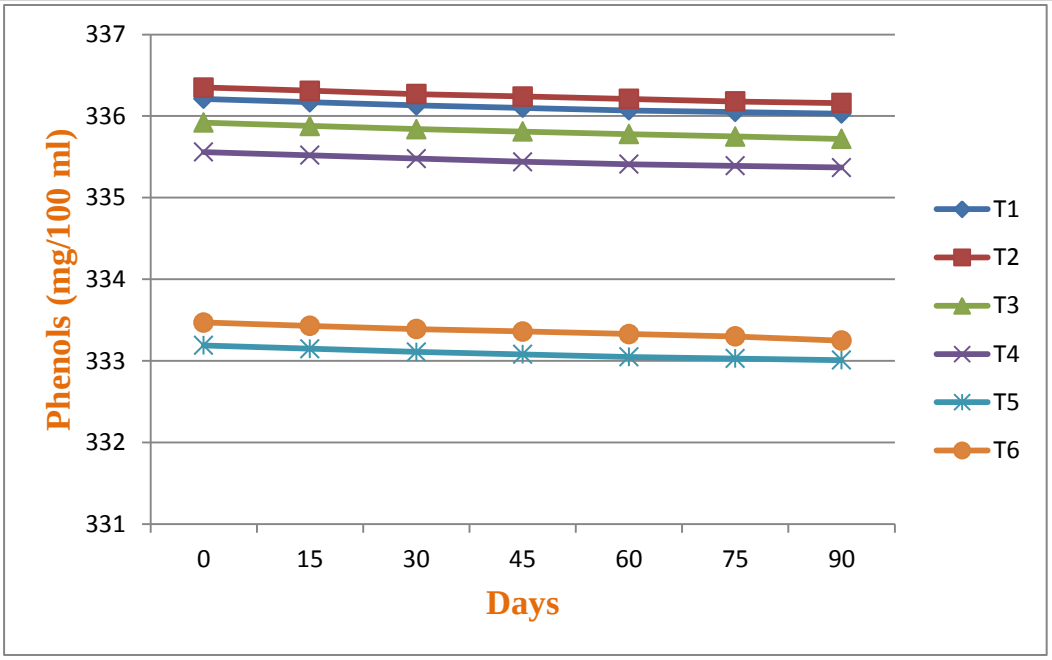

Fig. 4: Changes in phenols (mg/100 ml) of jamun and pomegranate juice blends as influenced by different treatments during storage period

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