

Preparation of Tamarind Jam Blended with Mango

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ABSTRACT

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A study was conducted to evaluate the physico-chemical, sensory quality characteristics and storage stability of the developed products prepared with tamarind by blending with mango pulp. Tamarind pulp was used for the preparation of jam by blending with different levels (10%, 20%, 30%, 40% and 50%) of mango pulp. These prepared products were evaluated for Physico-chemical, sensory and microbial attributes during the storage period at room temperature. The overall acceptability was the highest in jam prepared with 60% tamarind pulp + 40% mango pulp (T₅), and stored without any deterioration and consumer acceptable up to 3 months without affecting their quality.

Introduction

Tamarind is native fruit of Africa. It belongs to Leguminosae family with botanical name *Tamarindus indica*. L. It is one of the important tropical fruit tree, and is widely grows in India. It yields 150-500 Kg fruits per season and the fruit weight vary from 15-30 gms (Duke, 1981). Utilization of these fruits for preparation of various processed products are limited. Tamarind also has hypoglycemic and hypocholesterolemic effect and it helps in reducing obesity (www.tamarindmanual.htm). Blending of fruits like mango will be helpful to enhance the sensory quality characteristics such as color, flavour, taste, and overall acceptability of the prepared products. Keeping the above facts in view an experiment was planned for better utilization of tamarind.

Materials and Methods

Red variety tamarind was procured from local market and seeds were removed and the tamarind was cleaned properly. Then the tamarind was soaked in water in the 1: 1.5 ratio, heated up to 100⁰C, then cooled and crushed. After crushing it was passed through a sieve to obtain pulp. The pulp so obtained was used for the preparation of products. The flow diagram for extraction of tamarind pulp was given in (Fig. 1). Mangoes also procured from local market and cleaned properly.

Preparation of tamarind jam

Tamarind pulp was used for the preparation of jam by blending with different levels (10%, 20%, 30%, 40% and 50%) of mango pulp. Extracted pulp was mixed with sufficient

quantity of sugar and boiled. Boiling was continued till the required consistency was obtained. While boiling pectin was added. The flow diagram depicting preparation of jam was given in (Fig. 2).

Physico-chemical parameters of developed tamarind jam

Prepared products were analysed at monthly intervals for the following parameters Except Sensory evaluation (0 days, 45 days and 90 days).

Moisture (%)

The moisture content of the samples was determined by using the method of AOAC (1975).

Total soluble solids (⁰Brix)

The percentage of total soluble solids was determined using ERMA hand refractometer by placing a drop of the filtered juice on the refractometer prism. Before taking the reading, the refractometer was tested for error with distilled water (Ranganna, 1986).

Acidity (%)

Ten grams of homogenized sample was taken and made up to 100-ml. volume in a volumetric flask. The contents were then filtered through Whatman No.1 filter paper; an aliquot of 1 ml. was taken for titration against 0.1 N NaOH using phenolphthalein indicator and light pink colour as end point, to estimate titratable acidity in terms of tartaric acid (AOAC, 1975).

Reducing sugars (%)

Reducing sugars were determined by the method of Lane and Eyon (AOAC, 1975). Ten grams of samples was transferred to 250

ml volumetric flask using a little amount of distilled water. 2 ml of lead acetate. Solution was added to the flask for precipitation of colloidal matter and kept aside for 10 min. Then 2 ml of potassium oxalate solution was added to this solution to precipitate the lead and then the volume was made up to 250 ml using distilled water. And the contents were then filtered through Whatman no.1 filter paper. Reducing sugars in the lead free solution were then estimated by taking this solution in burette and titrating against 10 ml of standard Fehling's solution mix of A and B (1:1), using methylene blue as an indicator and formation of brick red precipitate as an end point. Keeping the Fehling's solution boiling on the heating mantle carried out the titration.

Total sugars (%)

For total sugars, 50 ml of filtered sample was taken in a 250 ml conical flask to which 50 ml water and 5 gm of citric acid was added boiled gently for 10 mins to complete the inversion of sucrose, then transferred to 250 ml volumetric flask and neutralized with 1N NaOH. The volume was made up to the mark and determined the total sugar as invert sugars (AOAC, 1975).

Sensory evaluation (Peryam *et al.*, 1957)

The sensory scoring was done by a panel of 10 members in the laboratory of Post Graduate and Research center using a scorecard developed for the purpose. Scorecard was prepared keeping in view of the quality characteristics of the products. Descriptive terms were given to various quality attributes like appearance, colour, flavour, texture, consistency, taste and overall acceptability. Numerical scores were assigned to each attribute (Peryam and pilgrim, 1959). A five-point scale was adopted to score each of the attributes, while scoring, highest score

(5) was assigned to most preferred characteristic and least score (1) to the least desired characteristics.

Total bacterial counts (Cruikshank *et al.*, 1975)

For estimating bacterial population in different samples, dilution plate method was followed (Cruikshank *et al.*, 1975). One gram of sample was thoroughly mixed in 9 ml of sterile saline water, from this, 1 ml of sample was transferred through a sterile pipette to a screw cap tube containing 9 ml sterile saline water, and this gives a dilution of 10^2 . Similarly, serial dilutions were made.

One ml. of the sterile serially dilute of sample was placed in the sterile petridish to which cooled plate count agar medium was added and mixed thoroughly with the suspension and then allowed to set and then incubated at $28 \pm 2^\circ\text{C}$ for 48 hrs.

Individual colonies were counted and multiplied. Dilution plate method was followed for yeast and mold content (Cruikshank *et al.*, 1975). Potato dextrose agar medium was used for estimating the fungal population.

Statistical analysis

The data were subjected to statistical analysis as per the procedure described by Panse and Sukhatme (1985). The experimental design was complete randomized design with factorial concept.

Results and Discussion

Prepared products were analyzed for physico chemical parameters Moisture, TSS, Acidity, Reducing sugars, Total sugars, sensory and microbial characteristics. The results were shown in the Table 1 to 6 and Figure 4.

Physico-chemical parameters of tamarind jam

Moisture (%)

A significant decrease at 1% level in moisture was observed (Table 1) after 90 days of storage. Tripathi *et al.*, (1988) in jam prepared with amla products and Jain *et al.*, (1983) reported similar observations.

Total soluble solids (Brix)

The total soluble solids (TSS) in tamarind jam (Table 2), though varied among the different treatments due to initial adjustment of higher Brix values, remained practically unchanged during storage.

During 30-90 days of storage, a very slight increase in T.S.S was observed, which remained statistically non-significant. These results were in accordance with the results reported by Jadhav *et al.*, (2004) in karonda jam, Koli *et al.*, (2004) in sapota jam and Tripathi *et al.*, (1988) in amla jam. This may be due to the concentration effect as the products lost moisture during storage (Tripathi *et al.*, 1988). The increase in TSS content may also be due to conversion of polysaccharides into sugars (Singh *et al.*, 2004).

Acidity (%)

During storage, there was practically no change in acidity of tamarind jam (table 3) stored at room temperature up to three months of storage. Similar reports were observed by Salvi (1991) in karonda products. Though, there was a slight decrease in acidity from 60 days to 90 days of storage, it remained statistically non-significant. Similar findings in jamun fruit products Garande and Joshi (1995) and in karonda fruit products (Jadhav *et al.*, 2004) were reported.

Table.1 Effect of storage period on moisture (%) in tamarind jam at room temperature

TREATMENTS	Moisture (%)				
	0	30	60	90	Mean
T ₁	68.40	68.02	68.01	68.01	68.11
T ₂	68.39	68.02	68.01	68.01	68.108
T ₃	68.42	68.06	68.02	68.02	68.01
T ₄	68.37	68.08	68.02	68.02	68.123
T ₅	68.35	68.1	68.02	68.02	68.123
T ₆	68.40	68.12	68.02	68.02	68.14
Mean	68.388	68.067	68.017	68.017	
		F value	SEd ±	CD at 5%	
Treatments (F₁)		**	1.78	2.309	
Periods (F₂)		**	1.443	2.828	
F₁ * F₂ Interaction		**	2.886	5.656	

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Table.2 Effect of storage period on T.S.S (⁰Brix) in tamarind jam at room temperature

TREATMENTS	T.S.S (⁰ Brix)				
	0	30	60	90	Mean
T ₁	65.00	65.00	65.33	65.35	65.162
T ₂	65.00	65.00	65.31	65.34	65.150
T ₃	65.00	65.00	65.34	65.36	65.134
T ₄	68.00	68.00	68.32	68.33	68.160
T ₅	68.00	68.00	68.30	68.32	68.158
T ₆	68.00	68.00	68.32	68.33	68.165
Mean	66.50	66.50	66.80	66.83	
		F value	SEd ±	CD at 5%	
Treatments (F₁)		**	0.0992	0.01987	
Periods (F₂)		NS	0.0701	NS	
F₁ * F₂ Interaction		NS	0.01718	NS	

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Table.3 Effect of storage period on acidity (%) in tamarind jam at room temperature

TREATMENTS	Acidity (%)				
	0	30	60	90	Mean
T ₁	0.653	0.653	0.651	0.647	0.651
T ₂	0.693	0.693	0.691	0.687	0.691
T ₃	0.724	0.724	0.722	0.719	0.722
T ₄	0.754	0.754	0.751	0.749	0.752
T ₅	0.783	0.783	0.781	0.776	0.780
T ₆	0.822	0.738	0.820	0.817	0.820
Mean	0.738	0.738	0.737	0.736	
		F value	SEd±	CD at 5%	
Treatments (F₁)		**	0.0011	0.0021	
Periods (F₂)		NS	0.007	NS	
F₁ * F₂ interaction		NS	0.0018	NS	

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Table.4 Effect of storage period on reducing sugars in tamarind jam at room temperature

TREATMENTS	Reducing sugars (%)				
	0	30	60	90	Mean
T ₁	32.130	32.131	33.280	35.180	32.180
T ₂	33.961	33.961	34.850	36.240	33.753
T ₃	35.229	35.230	35.961	38.320	35.435
T ₄	37.150	37.150	38.341	40.150	38.198
T ₅	38.761	38.761	39.560	41.230	39.578
T ₆	40.219	40.219	41.340	43.560	41.335
Mean	36.241	36.242	37.388	38.796	
		F value	SEd±	CD at 5%	
Treatments (F₁)		**	0.5607	0.1230	
Periods (F₂)		**	0.3964	0.7941	
F₁*F₂ Interaction		**	0.9711	1.9451	

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Table.5 Effect of storage period on total sugars (%) in tamarind jam at room temperature

TREATMENTS	Total sugars (%)				
	0	30	60	90	Mean
T ₁	51.390	51.390	51.480	51.322	51.396
T ₂	52.548	52.548	52.952	52.786	52.708
T ₃	54.673	54.672	54.945	54.851	54.785
T ₄	57.830	57.830	57.958	57.853	57.868
T ₅	59.798	59.798	59.852	59.629	59.768
T ₆	62.823	62.822	62.986	62.875	62.876
Mean	56.560	56.560	56.595	56.552	
		F value	SEd±	CD at 5%	
Treatments (F₁)		**	0.0658	0.1334	
Periods(F₂)		NS	0.0465	NS	
F₁*F₂ INTERACTION		NS	0.1139	NS	

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Table.6 Effect of storage period on microbial load (colony forming units/gm) in tamarind jam at room temperature

TREATMENTS	Microbial load(colony forming units/gm)							
	0 Days		30 Days		60 Days		90 Days	
	Bacteria	Y& M	Bacteria	Y& M	Bacteria	Y& M	Bacteria	Y& M
T ₁	-	-	-	-	-	-	4x10 ¹	5x10 ¹
T ₂	-	-	-	-	-	-	4x10 ¹	4x10 ¹
T ₃	-	-	-	-	-	-	3x10 ¹	3x10 ¹
T ₄	-	-	-	-	-	-	3x10 ¹	2x10 ¹
T ₅	-	-	-	-	-	-	2x10 ¹	1x10 ¹
T ₆	-	-	-	-	-	-	2x10 ¹	2x10 ¹

Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%. ** significant at 1% level, NS- non significant.

Fig.1 Flow -chart for extraction of tamarind pulp

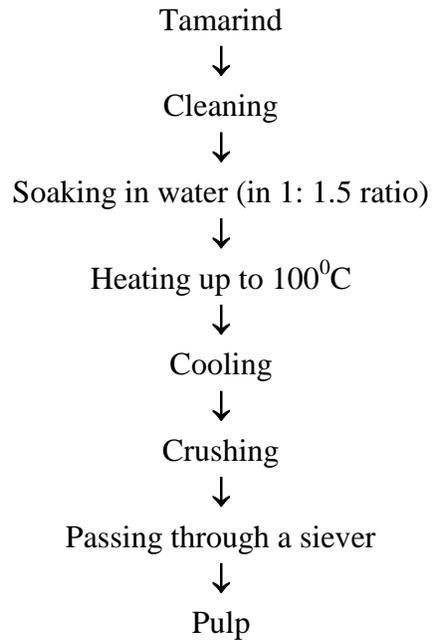


Fig.2 Flow- chart for preparation of tamarind jam

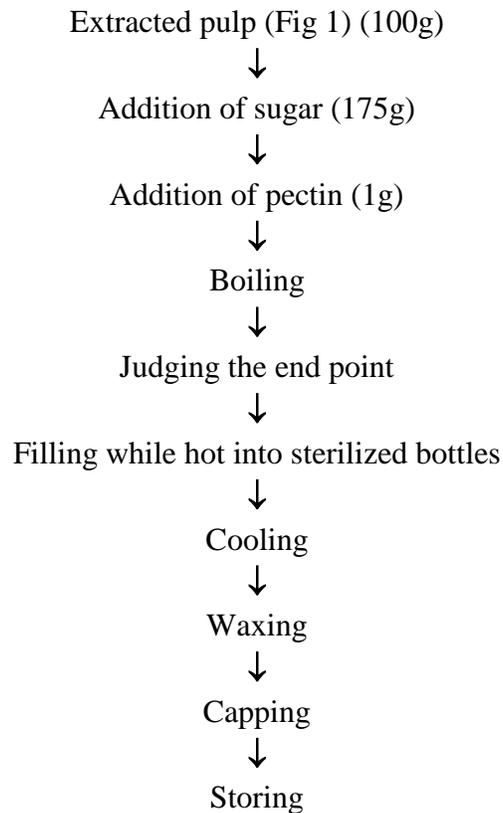
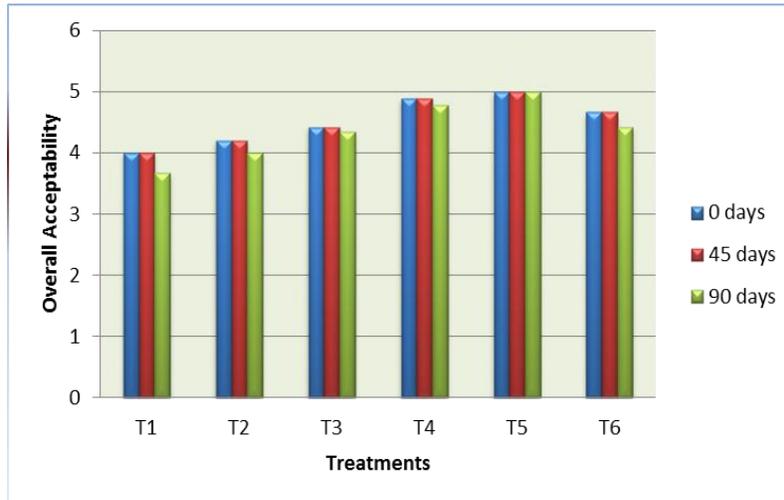
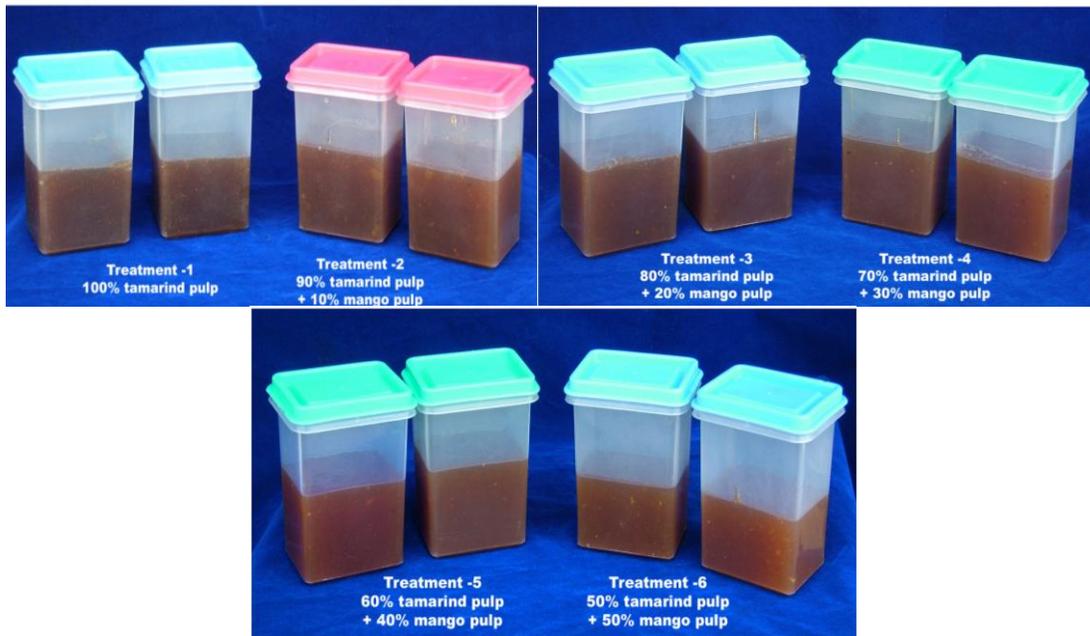


Fig.3 Effect of storage period on overall acceptability in tamarind jam at room temperature



Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%.

Fig.4 Tamarind jam by blending with mango pulp



Where, T₁: tamarind pulp 100%, T₂: tamarind pulp 90%+mango pulp10%, T₃: tamarind pulp 80%+mango pulp 20%, T₄: tamarind pulp 70%+mango pulp 30%, T₅: tamarind pulp 60%+mango pulp 40%, T₆: tamarind pulp 50%+mango pulp 50%.

Among treatments, significant changes were found in acidity, which might be due to initial differences in acidity maintained during processing.

Reducing sugars (%)

Reducing sugars were found to be increased significantly (Table 4) throughout the storage

period. The significant increase in reducing sugars may be due to inversion of non-reducing to reducing sugars (Tripathi *et al.*, 1988). Similar findings were reported by Shah and Bhatia (1983), Koli *et al.*, (2004) and Kannan and susheela (2001).

Total sugars (%)

During storage of tamarind jam, there was practically no change in total sugar content (Table 5) at room temperature upto three months of storage. Similar findings were observed by Ghulam Hassan Shah and Bhatia (1983) in culled apple products. There was a slight increase in total sugars at 60 days of storage, which might be due to increased degree of inversion of sugar on account of higher fixed acidity. Similar findings were reported by Tripathi *et al.*, (1988) in amla jam. At 90 days of storage, a slight decline in total sugars was observed, which might be due to significant increase in reducing sugars. Thus, at the expense of non-reducing sugars, reducing sugars might have increased. This finding was in conformity with the results of Kannan and Susheela Thirumaran (2001) in jamun fruit products.

Sensory evaluation

All the products were evaluated for sensory attributes (Fig. 3) by a panel of 10 judges for their appearance, colour, consistency, flavour, taste and overall acceptability. A maximum score of 5 was taken as a standard for considering the quality of the products. Of all the treatments, T₅ was found to be excellent for all the sensory parameters, at all storage intervals. All the treatments were found acceptable, T₅ being highly acceptable. All the samples retained their characteristic tamarind taste and aroma, consistency and overall acceptability throughout the period of storage. The jam samples also retained its normal colour during entire storage period.

Significant decrease was not found in tamarind jam after 90days of storage. Similar trend was observed by Jadhav *et al.*, (2004) in karonda products.

Microbial Load

A slight increase in microbial load was observed in all the samples during the storage period. However, the increase in microbial growth (Table 6) was within the permissible limit. Application of heat during processing irrespective of holding time reduced the microbial load. Preservative action of sugar also might have resulted in lower microbial load (Srivastava and Kumar, 2002). However, there was negligible growth of yeast and mold in the samples. The findings are in conformity with earlier workers (Kannan and Susheela Thirumaran, 2001).

The overall acceptability was the highest in the jam prepared with 60% tamarind pulp + 40% mango pulp (T₅), stored without any deterioration in physicochemical, sensory quality and microbial count and are consumer acceptable up to 3 months of storage as per the study. Profit estimated for 1kg of the tamarind jam was 25.00 when compared with locally available jam. Hence, it can be concluded that blending with mango pulp can bring value addition to tamarind.

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