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RESEARCH PAPER

Comparative study of jam preparation from various cultivars of mango and mango – papaya blends

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SUMMARY :

A comparative study on preparation of jam from three mango cultivars *viz*., Dashehari, Totapuri and Desi in combination with papaya was undertaken. The mango and papaya pulps were blended in the ratio of 100:00, 85:15, 70:30 and 55:45. Jams were prepared as per FPO specifications in which TSS was raised to a minimum of 68.5^{0}B by adding sugar and acidity was maintained at 0.6 per cent using citric acid. Jams prepared were stored under ambient condition in glass containers and subjected to physico-chemical analysis at two months interval for a period of six months. The highest TSS (69.78^{0}B), total sugars (64.72%), reducing sugars (32.46%) and total carotenoids (7.60 mg / 100 g) were recorded in T_{10}(Desi), whereas maximum acidity (0.652%), pectin (0.87%), dry matter (75.44%) and ash (3.27%) were recorded in T_6 (Totapuri). The maximum ascorbic acid content of 23.79 mg/ 100 g was found in T_{13} (Desi + Papaya; 55:45) and minimum in T_6 (Totapuri). During storage, an increasing trend was observed in TSS, total sugars and reducing sugars, whereas acidity ascorbic acid, total carotenoids, pectin and ash decreased. The storability study revealed that jams were of good shelf life and can be kept at least for six months without affecting the quality attributes.

KEY WORDS : Jam, Mango, Papaya, Blends, Cultivars

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Mango (*Magnifera indica* L.) is one of the most important fruits crops of India and is very much relished for its succulence, exotic flavor and delicious taste throughout the world. India occupies 54% of the world's production in mango (Tharanathan *et al*., 2006).

There are nearly 1000 mango varieties in India but only 20 are cultivated on commercial scale. The popular commercial cultivars of northern region are Dashehari, Langra, Chausa and Bombay Green. Jammu region of J&K State is bestowed with an excellent wealth of mango mostly in Jammu and Kathua districts, whereas, its cultivation is localized to certain pockets of Udhampur and Rajouri Districts. Locally grown mangoes are found in lower and mid hills of J&K in the month of early July and are locally known as Desi amb (Local Mango). The colour and richness of aroma of these mangoes cannot fetch good price because of their smaller size. It remained neglected and has hardly received attention from post harvest technology view point, mango can be blended with number of other fruits for product preparations such as papaya with mango at 25-33% for beverage preparation (Kalra *et al*.,1991). Papaya (*Carica papaya* L.), popularly known as wonder fruit of tropics is one of the important fruit crops of India. It is a good source of natural sugars, vitamin A, vitamin C, calcium and phosphorus (Jeans, 1992). Being rich in nutrients, but due to poor flavor it can be blended with other fruits to improve their acceptability and make use of available nutrients (Khan *et al*., 1988). The medicinal property of papaya is also well known.

It improves digestion and is said to cure chronic constipation, piles dyspepsia of liver and spleen. Mango and papaya fruits have high perishability role and cannot be stored for longer periods, therefore need quick disposal and utilization. Jam is an intermediate moisture food prepared for boiling fruit pulp with sugar, pectin, acid and other ingredients to reasonably thick consistency firm enough to hold the fruit tissues in position (Lal *et al.*,1998). Therefore, in the present investigation, an attempt has been made to study the varietal differences, different treatment combinations of mango-papaya blends on quality of jam and to evaluate physico-chemical attributes of the finished products.

EXPERIMENTAL METHODS

Fully ripened healthy papaya and mango fruit cvs Dashehari, Totapuri and Desi (Local amb) were purchased from Fruit Trans-shipment Centre (FTC), Narwal, Jammu. The fruits were thoroughly washed under running tap water, peeled and stones were removed. Pulp was homogenized. Fine mesh sieve pulper with steel jacket was used. Pulp was pasteurized at 85ºC for five minutes. Pulp was allowed to cool and KMS @ 1000 ppm was added and mixed properly. Pulp was then filled in pre sterilized bottles, sealed with caps and then stored for further processing into jam. Matured and ripened papaya fruits were manually peeled using stainless steel knife and cut into small pieces. Seeds and inner whitish layers were discarded manually. Papaya pieces were crushed in a mixer and boiled with water for 30 min and then strained. KMS was added @ 1000 ppm and pulp was filled in pre-sterilized bottles of 650ml capacity for further processing. Jam was prepared by mixing requisite amount of sugar and citric acid to pulp of each mango variety and papaya alone and with different combinations of mango cvs with papaya in the ratio of 100:0, 85:15, 70:30 and 55:45, respectively.

Mixture was then cooked on a low flame to the desired consistency of jam with constant stirring. as per FPO specification. The prepared jam was filled hot in clean sterilized glass jars, sealed air tight and stored under ambient conditions. The samples of jams were analyzed for physico-chemical parameters.

Fruits and its pulp were subjected to the physico chemical analysis. Fruit weight was recorded using digital balance and average fruit weight was expressed in grams. Average length and width of the fruits were measured with the help of vernier calliper. Peels and stone percentage was found out from the weight of peel and stone, respectively in relation to total weight of fruit. Total soluble solids were recorded by Digital Abbes Refractometer. Total sugars, reducing sugars and acidity were determined by standard methods (Ranganna,1986). Ascorbic acid, pH, ash content and total carotenoids were estimated by standard methods (AOAC,1995).

The method given by Carre and Haynes (1992) was followed for estimation of total pectin as calcium pectate. The data recorded were analysed statistically using CRD and CRD factorial for interpretation of result through analysis of variance.

EXPERIMENTAL FINDINGS AND ANALYSIS

Perusal of data (Table 1) on physical characteristics of three mango cultivars revealed that Totapuri showed maximum average length12.04 cm and breadth 7.62 cm followed by Dasheheri which showed average length and breadth as 9.98 cm and 5.40 cm, respectively.

The Desi fruit showed minimum average length5.75 cm. Gowda and Hudder (2004) found maximum length for variety Totapuri *i.e.* 14.63 cm and lowest for variety Alphonso *i.e.*8.85 cm. Similary Kumar (1992) studied the average fruit length of 30 different Desi mango varieties of Jammu division which ranged between 5.10 to 14.38 cm. The maximum fruit weight was recorded in cultivar Totapuri 330.84g as shown in Table 1. Similarly observation was focused by Kumar (1992) while studying the average fruit weight of 30 different mango varieties of Jammu Division which ranged between 55 to 495g.

The highest pulp stone ratio of 8.16:1 was recorded in Totapuri mango followed by Dashehari 3.03:1 and Desi 1.79.1 cultivar.

The highest pulp percentage 85.09 was observed in Totapuri fruit and minimum in Desi mango *i.e.* 50.84. Desi cultivar exhibited maximum wastage percentage 49.16 followed by Dashehari 42.49 and Totapuri 14.91. Fresh papaya fruit was analyzed for various physical parameters and it was observed that mean fruit length, fruit breadth, fruit weight, pulp and wastage % were 15.9 cm, 11.5 cm, 1100 g, 74.13% and 25.87%, respectively.

Perusal of data (Table 1) on chemical composition of mango fruit revealed that maximum TSS 19.3ºB was found in Desi cultivar followed by Dashehari 19.1^{0}B and Totapuri 14.6^{0}B. Nandini and Oomen (2002) reported the TSS of different mango varieties ranged from 13.75 to 21.00. Maximum and minimum acidity of 0.62% and 0.52% was found in cultivar Desi and Totapuri, respectively. Total sugar content was maximum in Dashehari cultivar 14.19% and minimum in Totapuri 11.64% the reducing sugar was found to be maximum in Dashehari cultivar 6.34% and minimum in Totapuri 5.09%. The ascorbic and content was maximum in Dashehari 38.20mg/100g whereas it is minimum in Totapuri *i.e.* 19.36mg/100g. Similar observation was focused while studying ascorbic acid content of major north India varieties and it was found to be 42.50 mg/100g in Dashehari Cultivar (Singh *et al.*,1985). The maximum pH was observed in cultivar Desi 4.98%. Similar findings were reported in different mango

cultivars(Nandani and Oomen, 2002). The Totapuri mango recorded highest pectin 1.84% followed by Desi 1.28%. The results are in conformity with the findings of (Nwanekezi *et al.*,1994).

The total carotenoid content was recorded maximum in cv. Dashehari 8.82 mg/100g and minimum in Totapuri 3.69 mg / 100g. Adsule and Roy (1974) reported total carotenoids 9.06 mg / 100g in fully ripened fruit of cv. Dashehari. The ash content was maximum in cv. Totapuri 1.10 per cent and minimum in Dashehari 0.67 %. Singh (1960) reported ash content of thirty three varieties of mango which ranged between 0.26-1.16 %. Table 1 revealed fresh papaya fruit had TSS 9.50^{0}B acidity 0.094 %, ascorbic acid content 52.20mg/100g, total carotenoids 3.60mg/100g, total sugar 7.54, reducing sugar 1.55 %. These results are in conformity with the findings of Madhav Rao(1974), Jagtiani *et al.* (1998), Tiwari (2000) and Puranjay (2003).

The data presented in Table 2 revealed there was slight increase in TSS upto six months of storage. The maximum TSS 70.4ºB was recorded in T_{10} (Desi) and minimum 69.4ºB was observed in T_5 (Dashehari + papaya : 55 : 45) after six months of storage. The storage period did not affect the TSS of jam significantly. Increase in TSS might be due to partial loss of moisture as a result of evaporation from the product or due to solubilization of pulp constituents during storage. Similar findings were reported in Jamun jam during six months of storage at room temperature(Kannan and Thirumaran, 2004), in aonla jam (Pathak, 1988 and Deen, 1992) and in papaya jam (Kumar, 1990). There was significant decrease in the acidity per cent of jam from initial day to six months of storage (Table 3). At initial day of storage Totapuri jam recorded highest acidity of 0.662% followed by Desi having value 0.657%. After 6 months of storage. Totapuri recorded highest value of 0.647% and lowest value of 0.612% in T_5 (Dashehari + Papaya : 55 : 45). The maximum overall mean acidity of 0.652% was recorded in Totapuri whereas minimum acidity of (0.624%) was recorded in (Dashehari+ Papaya jam 55.45%). This might be attributed to hydrolysis of polysacchride and non reducing sugars in the presence of organic acid. Similar findings have been reported in jams prepared from guava, anola, bael and watermelon rind, respectively (Chadha, 1993; Mehta, 1995; Chand *et al.*, 2007 and Bhatnagar, 1991). Decrease in acidity was also reported in bael-mango blended jam upto 6 months of storage period (Singh *et al.*, 2005 a and 2005 b).

The total sugar content of mango jam increased during the entire storage period from mean value 61.89 to 65.22% after 6 months of storage (Table 3). Among the treatments T_{10} (Desi) recorded the highest value of 62.53% followed by treatment T_1 (Dashehari) with total sugar contet of (62.46%) at initial day. After 6 months storage, (treatment T_{10} Desi recorded highest value of (66.57%) followed by T_1 (Dashahari) having total sugar content of 65.92%. The increase in total sugar content during storage could be attributed to gradual inversion of non reducing sugars (Jain *et al.*,1988). These findings are in agreement with the earlier works on papaya jam (Kumar,1990). Similar results had been reported in jams prepared from different cultivars of mango (Kumar, 2008). The data pertaining to reducing sugars contents depicted in (Table 4). At initial day the highest value of reducing sugar 24.75 % was recorded in T_1 (Dashehari) followed by 24.00% in T_{10} (Desi). On the basis of overall mean value it was observed that reducing sugars 32.46 % were the highest in T_{10} (Desi) and lowest 25.96% in T_2 (Papaya)

Table 1 : Physico - chemical characteristics of mango and papaya fruits

Fruit		Mango			Papaya
Cultivar		Dashehari	Totapuri	Desi	-
Fruit size (cm)	length	9.98	12.04	5.75	15.90
	Breadth	5.40	7.62	4.58	11.50
Fruit weight (g)		128.04	330.84	81.20	1100
Pulp stone ratio		3.06:1	8.16:1	1.79:1	-
Pulp %		57.51	85.09	50.84	74.13
Wastage %		42.49	14.91	49.16	25.87
TSS(^{0} B)		19.1	14.6	19.3	9.50
Titratable acidity(%)		0.58	0.52	0.62	0.094
Total sugars (%)		14.19	11.64	14.00	7.54
Reducing sugars (%)		6.34	5.09	6.12	1.55
Ascorbic acid (mg/100g)		38.20	19.36	37.48	52.20
pH		4.84	4.68	4.98	5.51
Pectin (%)		0.92	1.84	1.28	0.78
Total carotenoids (mg/100g)		8.82	6.39	8.74	3.60
Ash (%)		0.67	1.10	0.90	0.75

after six months of storage. The reducing sugar content of jam increased significantly with increase in storage period which may be due to hydrolysis of polysaccharides and inversion of non-reducing sugars to reducing sugars. The change in reducing sugar content during storage coincide with the findings of (Kumar, 2008) in jams prepared from mango cultivars and blended apple apricot jam (Hussain and Shakir, 2010).

The pH slightly increased with the advancement of storage period (Table 4). At initial day, the maximum pH of 3.27 was recorded in Desi and minimum of 3.05 in (Dashehari + papaya ; 55:45). The mean value of pH increased from 3.16 at initial day of storage to 3.23 after 6 months of storage. The increase in the pH may be attributed to the corresponding

Table 2 : Effect of mango-papaya blends onTSS ^{0}B and titratable acidity(%) of jam during storage

Treatments	T.S.S (^{0} B)					Titratable acidity (%)				
	Storage (months)					Storage (months)				
	0	2	4	6	Mean	0	2	4	6	Mean
T_1 - Mango (*Dashehari)*	68.5	69.8	70.0	70.3	69.65	0.650	0.639	0.631	0.628	0.637
T_2 - Papaya	68.5	68.9	69.0	69.5	68.95	0.652	0.634	0.628	0.622	0.634
T_3 - *Dashehari* + Papaya (85:15)	68.6	68.9	69.2	70.2	69.23	0.648	0.632	0.625	0.620	0.631
T_4 - *Dashehari* + Papaya (70:30)	68.7	68.8	69.1	69.7	69.08	0.636	0.628	0.622	0.618	0.626
T_5 - *Dashehari* + Papaya (55:45)	68.6	68.6	69.0	69.4	68.93	0.640	0.624	0.619	0.612	0.624
T_6 - Mango (*Totapuri*)	68.8	69.0	70.0	70.3	69.53	0.662	0.651	0.648	0.647	0.652
T_7 - *Totapuri* + Papaya (85:15)	68.5	69.0	69.4	70.0	69.23	0.650	0.642	0.639	0.636	0.642
T_8 - *Totapuri* + Papaya (70:30)	68.6	69.2	69.4	69.8	69.25	0.648	0.638	0.632	0.629	0.637
T_9 - *Totapuri* + Papaya (55:45)	68.7	68.9	69.0	69.9	69.13	0.645	0.637	0.628	0.625	0.634
T_{10} - Mango (*Desi*)	68.9	69.8	70.0	70.4	69.78	0.657	0.646	0.644	0.640	0.647
T_{11} - *Desi* + Papaya (85:15)	68.8	68.6	69.8	70.3	69.38	0.645	0.640	0.633	0.631	0.637
T_{12} - *Desi* + Papaya (70:30)	68.7	68.8	69.4	70.2	69.28	0.642	0.638	0.632	0.628	0.635
T_{13} - *Desi* + Papaya (55:45)	68.5	68.6	69.3	69.8	69.05	0.638	0.635	0.627	0.623	0.631
Mean	68.65	68.99	69.43	69.99		0.647	0.637	0.631	0.628	
Effects CD (P= 0.05)					CD (P= 0.05)					
Treatment = 0.45					0.001					
Storage = N.S					0.001					
Treatment ×Storage =N.S					0.002					

Table 3 : Effect of mango-papaya blends on total sugars (%) and reducing sugar (%) of jam during storage

Treatments	Total Sugars (%)					Reducing Sugars(%)				
	0	2	4	6	Mean	0	2	4	6	Mean
T_1 Mango (*Dashehari)*	62.46	63.28	64.35	65.92	64.00	24.75	31.33	34.00	39.60	32.42
T_2 Papaya	60.97	61.05	62.14	63.26	61.86	17.60	23.24	29.21	33.78	25.96
T_3 *Dashehari* + Papaya (85:15)	62.39	63.33	64.15	65.76	63.90	23.82	29.30	33.72	38.59	31.36
T_4 *Dashehari* + Papaya (70:30)	62.33	63.20	64.00	65.68	63.80	23.54	28.72	33.64	38.00	30.98
T_5 *Dashehari* + Papaya (55:45)	62.24	63.00	63.92	65.39	63.64	23.36	28.50	32.21	37.43	30.38
T_6 Mango (*Totapuri*)	61.36	62.58	63.26	65.16	63.09	23.14	30.21	32.20	37.28	30.71
T_7 *Totapuri* + Papaya (85:15)	61.30	62.48	63.10	64.73	62.90	22.41	28.00	31.16	36.72	29.57
T_8 *Totapuri* + Papaya (70:30)	61.18	62.36	63.00	64.37	62.73	21.94	27.46	30.52	36.00	28.98
T_9 *Totapuri* + Papaya (55:45)	60.73	61.68	62.70	63.65	62.19	21.73	27.20	29.71	35.33	28.49
T_{10} Mango (*Desi*)	62.53	64.32	65.46	66.57	64.72	24.00	31.25	35.00	39.42	32.46
T_{11} *Desi* + Papaya (85:15)	62.40	63.33	64.25	65.87	63.96	23.80	29.23	35.81	39.01	31.96
T_{12} *Desi* + Papaya (70:30)	62.38	63.17	64.23	65.78	63.89	23.62	29.00	35.73	38.98	31.83
T_{13} *Desi* + Papaya (55:45)	62.32	63.10	64.20	65.76	63.85	23.40	28.22	34.80	37.74	31.04
Mean	61.89	62.84	63.75	65.22		22.85	28.58	32.90	37.53	
Effects CD (P= 0.05)					CD (P= 0.05)					
Treatment = 0.81					0.81					
Storage = 0.45					0.45					
Treatment ×Storage = 1.62					1.62					

decrease in the acidity of the Jams during storage. An increase in pH value of sand pear and bagu gosha candy was observed in similar storage conditions(Rani and Bhatia,1985).

Pectin content are important in setting the Jam. During storage the pectin content declined in all the treatment. Highest pectin content 0.79 % was recorded in treatment T_6 (Totapuri) till the end of storage period and lowest 0.39% pectin content was recorded in papaya jam.

The decrease in pectin substance during storage period was possible due to conversion of pectin to soluble material. Similar results were reported in water melon jam (Bhatnagar, 1991) and mixed jam prepared from strawberry, banana and

Table 4 : Effect of mango-papaya blends on pH and pectin (%) of jam during storage

Treatments	pH					Pectin (%)				
	Storage (months)					Storage (months)				
	0	2	4	6	Mean	0	2	4	6	Mean
T_1 Mango (*Dashehari)*	3.12	3.14	3.15	3.17	3.14	0.87	0.76	0.66	0.55	0.71
T_2 Papaya	3.22	3.26	3.28	3.31	3.27	0.70	0.62	0.52	0.39	0.55
T_3 *Dashehari* + Papaya (85:15)	3.10	3.16	3.18	3.21	3.16	0.83	0.75	0.65	0.59	0.70
T_4 *Dashehari* + Papaya (70:30)	3.08	3.16	3.18	3.19	3.15	0.81	0.71	0.62	0.53	0.66
T_5 *Dashehari* + Papaya (55:45)	3.05	3.18	3.20	3.22	3.16	0.78	0.69	0.61	0.50	0.64
T_6 Mango (*Totapuri*)	3.18	3.19	3.20	3.24	3.20	1.00	0.87	0.82	0.79	0.87
T_7 *Totapuri* + Papaya (85:15)	3.16	3.17	3.18	3.19	3.17	0.93	0.85	0.81	0.76	0.83
T_8 *Totapuri* + Papaya (70:30)	3.14	3.15	3.15	3.16	3.15	0.89	0.82	0.77	0.74	0.80
T_9 *Totapuri* + Papaya (55:45)	3.11	3.12	3.14	3.14	3.12	0.87	0.79	0.76	0.73	0.78
T_{10} Mango (*Desi*)	3.27	3.29	3.30	3.32	3.30	0.89	0.86	0.78	0.73	0.81
T_{11} *Desi* + Papaya (85:15)	3.25	3.26	3.28	3.30	3.27	0.85	0.82	0.76	0.70	0.78
T_{12} *Desi* + Papaya (70:30)	3.22	3.26	3.27	3.30	3.26	0.83	0.76	0.72	0.68	0.74
T_{13} *Desi* + Papaya (55:45)	3.18	3.25	3.25	3.29	3.24	0.78	0.73	0.66	0.64	0.70
Mean	3.16	3.19	3.21	3.23		0.84	0.77	0.70	0.64	
Effects	CD (P= 0.05)									CD (P= 0.05)
Treatment =	0.01									0.01
Storage =	0.01									0.01
Treatment ×Storage =	0.02									0.02

Table 5 : Effect of mango-papaya blends on ascorbic acid (mg/100g) and total carotenoids (mg/100g) of jam during storage

Treatments	Ascorbic acid (mg/100g)					Total Carotenoids (mg/100g)				
	Storage (months)					Storage (months)				
	0	2	4	6	Mean	0	2	4	6	Mean
T_1 Mango (*Dashehari)*	23.20	21.02	19.00	16.05	19.82	8.12	7.59	7.40	7.19	7.58
T_2 Papaya	25.43	23.17	20.50	18.31	21.85	3.14	3.00	2.49	2.37	2.75
T_3 *Dashehari* + Papaya (85:15)	23.36	21.08	21.06	19.20	21.18	7.32	7.00	6.73	6.48	6.88
T_4 *Dashehari* + Papaya (70:30)	23.70	21.12	21.00	20.48	21.58	7.05	6.80	6.00	5.81	6.42
T_5 *Dashehari* + Papaya (55:45)	24.03	22.73	22.36	21.73	22.71	6.28	5.71	5.10	4.93	5.51
T_6 Mango (*Totapuri*)	18.30	17.20	16.00	15.83	16.83	6.15	5.92	5.24	5.00	5.58
T_7 *Totapuri* + Papaya (85:15)	19.36	19.03	18.24	17.09	18.43	6.00	5.68	5.12	4.88	5.42
T_8 *Totapuri* + Papaya (70:30)	20.43	19.73	18.18	16.92	18.82	5.28	5.00	4.62	4.10	4.75
T_9 *Totapuri* + Papaya (55:45)	22.61	22.06	21.32	20.54	21.63	5.09	4.48	4.27	4.00	4.46
T_{10} Mango (*Desi*)	22.82	22.26	21.45	20.63	21.79	8.24	7.90	7.42	7.23	7.60
T_{11} *Desi* + Papaya (85:15)	23.20	22.88	21.92	21.00	22.25	7.52	7.14	6.80	6.40	6.97
T_{12} *Desi* + Papaya (70:30)	23.62	23.10	22.56	22.23	22.88	7.32	7.05	6.50	6.24	6.78
T_{13} *Desi* + Papaya (55:45)	24.01	23.96	23.61	23.58	23.79	6.80	6.00	5.64	5.10	5.89
Mean	22.62	21.49	20.55	19.51		6.49	6.10	5.64	5.33	
Effects	CD (P= 0.05)					CD (P= 0.05)				
Treatment =	0.80					0.32				
Storage =	0.44					0.18				
Treatment ×Storage =	1.61					N.S				

Table 6 : Effect of mango-papaya blends on dry matter (%) and ash content (%) of jam during storage

Treatments	Dry matter (%)					Ash content (%)				
	Storage (months)					Storage (months)				
	0	2	4	6	Mean	0	2	4	6	Mean
T_1 Mango (*Dashehari)*	71.97	71.53	71.66	71.00	71.54	3.17	3.14	3.12	3.10	3.13
T_2 Papaya	69.97	70.38	70.52	70.00	70.22	3.12	3.12	3.10	3.05	3.10
T_3 *Dashehari* + Papaya (85:15)	73.80	73.65	73.74	72.71	73.48	3.13	3.12	3.10	3.09	3.11
T_4 *Dashehari* + Papaya (70:30)	72.20	71.63	71.56	71.68	71.76	3.14	3.13	3.11	3.10	3.12
T_5 *Dashehari* + Papaya (55:45)	70.82	70.57	70.79	70.22	70.60	3.14	3.14	3.13	3.13	3.13
T_6 Mango (*Totapuri*)	75.60	75.10	75.26	75.82	75.44	3.33	3.29	3.24	3.22	3.27
T_7 *Totapuri* + Papaya (85:15)	75.54	74.30	74.49	74.74	74.76	3.30	3.28	3.22	3.20	3.25
T_8 *Totapuri* + Papaya (70:30)	75.00	74.70	74.30	74.32	74.58	3.27	3.26	3.23	3.20	3.24
T_9 *Totapuri* + Papaya (55:45)	74.00	73.70	74.20	73.69	73.89	3.25	3.24	3.22	3.19	3.22
T_{10} Mango (*Desi*)	72.53	72.35	72.49	72.44	72.45	3.20	3.18	3.14	3.12	3.16
T_{11} *Desi* + Papaya (85:15)	71.40	71.27	71.20	71.32	71.30	3.19	3.18	3.16	3.10	3.15
T_{12} *Desi* + Papaya (70:30)	72.00	72.65	72.73	72.76	72.54	3.19	3.17	3.13	3.09	3.14
T_{13} *Desi* + Papaya (55:45)	70.20	69.50	70.00	70.10	69.95	3.18	3.17	3.12	3.08	3.13
Mean	72.69	72.41	72.53	72.36		3.20	3.18	3.15	3.12	
Effects	CD (P= 0.05)					CD (P= 0.05)				
Treatment =	0.81					0.01				
Storage =	N.S.					0.01				
Treatment ×Storage =	N.S.					0.02				

mulberry (Badal, 2006).

There was significant decrease in the ascorbic acid content in mango jam during storage (Table 5). At initial day of storage, the highest ascorbic acid content of (24.01 mg/ 100g) was recorded in T_{13} (Desi+papaya 55:45). Overall mean highest ascorbic acid content was (23.79 mg/100g) recorded in T_{13} and lowest (16.83 mg/100g) was recorded in T_6 (Totapuri) during six months of storage.The reason for maximum ascorbic acid content in T_{13} (Desi+papaya 55:45) was due to high initial ascorbic acid content in Desi variety along with papaya pulp which is also rich in ascorbic acid. The decline in the ascorbic acid content might be due to thermal oxidation in storage and also may be due to presence of residual oxygen in glass jars which convert ascorbic acid to dehydroascorbic acid. Similar results were observed in aonla jam (Tripathi *et al*.,1988) in papaya jam (Kumar, 1990) and in blended apricot apple jam (Hussain and Shakir, 2010).

A significant decrease in total carotenoid occurred during storage period of six months (Table 5). It decreased from initial mean value of 6.49 to 5.33 mg/100g after six months of storage. The maximum carotenoids (7.23mg/100g) was retained by jam prepared from Desi mango (T_{10}) and lowest content was recorded in T_2 (Papaya). Highest mean carotenoid content of (6.49 mg / 100g) was recorded at initial day storage and lowest value (5.33mg./100g) was recorded after 6 months of storage.

The degradation in total carotenoids during storage was probably due to effect to high temperature and enzyme activation in pigment. Similar decreasing trend in total carotenoids was reported in papaya jam (Sarvanan *et al*., 2004).

Table 6 revealed that dry matter content fluctuated marginally from 72.69 to 72.36 during six months of storage. At initial day the treatment T_6 (Totapuri) recorded the highest dry matter content of 75.60% and lowest 69.97% was recorded in treatment T_2 (Papaya). After 6 months of storage the treatment T_6 recorded highest dry matter content 75.82% followed by T_7.(totapuri+papaya 85:15) Fluctuation in dry matter content may also be due to activity of microorganism and catalytic enzyme produced by them (Ashaye *et al*.,2006). Similar results have been reported in jams prepared from Saudi date cultivar upto 32 weeks of storage (Yousif and Alghamdi, 2000). Table 6 revealed that ash content of different treatments decreased marginally during storage from initial mean value of 3.20 to 3.12%. The highest ash content was retained by treatment T_6(Totapuri) during the entire storage period. Similar decrease in Rosella jam during entire storage period was reported (Ashaye and Adeleke, 2009).The lower ash content is due to increased activity of microorganism utilizing the minerals for growth.

Conclusion:

It is thus concluded that Dashehari, Totapuri and Desi cultivars of mango can be suitably used for preparation of mango / mango papaya blended Jam. The totapuri cultivar with high pulp recovery is excellent for processing and storage characteristic. The Desi cultivar of mango can be suitably blended with high proportion of papaya *i.e.* (55:45) ratio to

enhance the nutritive value of jam.

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