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QUALITY EVALUATION AND STORAGE STABILITY OF JAMUN-MANGO BLENDED JAM

DEEP SHIKHA SHARMA*
Division of Post Harvest Technology, SKUAST-J, Udheywalla - 180 002, INDIA
e-mail: deepshikha20202@yahoo.com

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***Corresponding author**

ABSTRACT
Studies were conducted on the manufacture of value added product from jamun-mango blended fruit pulp. Jamun and mango fruits were blended in the ratios of 55:00:: jamun: mango pulp as control, 50:05, 45: 10, 40: 15 and 35: 20:: jamun: mango pulp for the preparation of jam. In jam production the total soluble solids and total sugar increased from the initial levels of 68.00 to 71.12 ^{0}Brix and 55.99 to 56.30 percent, where as the anthocyanin, tannin, iron and phosphorus contents decreased from 58.88 to 51.76 mg/100g, 158.83 to 158.77 mg/100ml, 0.50 to 0.46 mg/100g and 10.75 to 10.71 mg/100g during six months of storage. On the basis of sensory score the blend/treatment T_3(45:10:: jamun: mango) received the maximum score of 8.74 for body, 8.66 for colour, 8.64 for aroma and 8.74 for overall acceptability which decreased to 7.84, 7.80, 7.96 and 7.04 after six months of storage respectively. No microbial count was observed in treatment T_2 (50:05: Jamun: Mango), T_3 (45:10: jamun: mango) and T_4 (40:15: jamun: mango) after six months of storage.

INTRODUCTION

Jamun (*Syzygium cumini* L.) belongs to family Myrtaceae and is indigenous to India. It is generally grown as avenue or as wind break. It is widely grown from Indo-Gangetic plains in north to Tamil Nadu in South. Its fruit is delicious and is of wider interest for its medicinal application than for its edible fruit. Different parts of the tree such as bark, fruit and seed posses medicinal and therapeutic values (Kirtikar *et al*., 1990; Noomirio and Dahot, 1996). The fruit is highly perishable and can be stored only upto 2-3 days under ambient temperature. However, in cold storage (3-4ºC and 85-90% RH) it can be stored for only 12 days.

Due to perishable nature of fruits, they require immediate processing to avoid post-harvest losses. As jamun pulp is acidic as well as astringent and therefore not generally preferred and therefore, blending of two or more pulps and their beverages is thought to be a convenient alternative for utilizing them in developing some value added fruit drinks, which will be of high quality in respect to both sensory and nutritional aspects. The blending of fruit could be as economical proposition to utilize them profitably, because, some fruit varieties may not have favourable characteristics for processing and cost viability for product preparation. The possibility of enhancing the flavour and acceptability by diversification has been suggested by (Kalra *et al*., 1991).

Secondly, it is reported that blending of fruit helps in improving nutrient elements, reducing cost of production by using cheaper fruits in the blends and also leads to new product development (Kalra *et al*., 1991). Moreover, they found that fruits, which are rich in nutrients but not acceptable due to high acidity or poor taste and flavour can be blended with other fruits to improve their acceptability and make use of available nutrients.

Moreover, there is always a demand from the consumers all over the world for new products, which should be nutritious and delicately flavoured. Thus, developing processing technologies on the blended products may result not only in better utilization of less exploited fruit crop but also the production of value added products along with gainful employment opportunities. Keeping in view the above, the present investigation on has been undertaken for quality evaluation and storage stability of jamun mango blended jam.

MATERIALS AND METHODS

The present investigation was carried out in the Division of Post Harvest Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu. The jamun fruits were washed crushed for the extraction of pulp and on the other hand mango fruit was washed, peeled and passed through the pulper for obtaining the pulp. The pulp so obtained was passed through stainless steel strainer, homogenized followed by heating at 85ºC for 30 second. Preparation of jamun-mango blended jam: **-** Jam was prepared using 55 percent of blended jamun: mango pulps as per the procedure of Prasad and Mali (2006). Jamun and mango fruits pulp were blended in the ratios of 55: 00: jamun: mango pulp as control, 50: 05: jamun: mango, 45: 10: jamun: mango, 40: 15: jamun: mango and 35: 20: jamun: mango. Blended pulp was cooked along with the desired quantities of sugar and citric acid with constant stirring on a uniform flame, till the

total soluble solids and acidity reached to 68 ºBrix and 0.4 percent respectively. The jam was filled hot in pre-sterilized glass bottles, cooled, sealed and kept upside down for some time then stored at room temperature after proper labelling. The Jam prepared was analyzed at period ical intervals of 0, 2, 4 and 6 months for the physico-chemical, organoleptic and micro biological parameters.

Determine the physico-chemical properties of jamun mango

Blended Jam

Analysis of jams were conducted for various physico-chemical constituents following standard procedures of AOAC (2002), Sensory appeal is determined by appearance, texture and flavour (Bourne, 2002, Ranganna, 2001).

TSS (ºBrix) and acidity (%) measurement of jamun mango blended jam was evaluated using the method as recommended by Ranganna (2008). Microbial analysis was done to determine the Total Plate Count (TPC) of micro-organisms as the method suggested by Harrigan and McCance (1966). Completely Randomized Design (CRD) and CRD factorial were used for interpretation of results though analysis of variance.

RESULTS AND DISCUSSION

Total soluble solids

Statistically the total soluble solids of blended jam increased significantly during six months of storage (Table 1). The increase in total soluble solids might be due to partial hydrolysis of polysaccharides like cellulose, starch and pectic substances into simple substance. Similar results were reported by Saravaran *et al*. (2004) in papaya jam, Badal *et al*. (2006) in (strawberry, banana and mulberry) blended jam, Prasad and Mali (2006) in ber jam. The results were also in accordance with the findings Hussain and Shakir (2010) in apricot and apple blended jam.

Titratable acidity

The percent acidity in all the blended jams increased significantly. Sogi and Singh (2001) reported that increase in acidity during storage could be due to ascorbic acid degradation on hydrolysis of pectin. Similar increase in titratable acidity during storage have also been reported by Shakir *et al*. (2008), Hussain and Shakia (2010) and Prasad and Mali (2006) while working on apple and pear mixed fruit jam, apricot–apple blended jam and in ber jam respectively.

Sugars

With the increase in storage period both reducing and total sugars of jamun-mango blended jams increased. Increase in reducing sugars during storage might be due to hydrolysis of polysacca- harides and inversion and non- reducing sugars to reducing sugars. The present findings are also in conformity with the reported works of Kannan and Thirumaran (2001) in jamun jam, Sogi and Singh (2001) in Kinnow jam, Shakir *et al*. (2008) in apple and pear mixed jam. Hussain and Shakia (2010) also reported that increase in reducing sugar might be due to prolong storage and hydrolysis of sugars with increase in acidity and decrease in pH which also conforms the present finding. Similar increase in reducing sugar during storage period was observed by Karanjalker (2013).

The increase in total sugar during storage could be attributed to gradual inversion of non - reducing sugars (Jain *et al*., 1988) and also to the breakdown of polysaccharides into simple sugars (Sogi and Singh, 2001) in Kinnow jam.

Anthocyanin

Significant decrease in anthocyanin content was observed with the advancement of storage period after six months of storage. Minimum loss of anthocyanins was found in treatment T_3 (45:10: jamun: mango). Kim and Zakour (2004) reported 11 per cent (raspberry cv Prelude) to 79 per cent (plum cv. Balaton jam) loss in total anthocyanins during jam processing.

Table 1: Effect of treatments and storage period on physico chemical changes of jamun-mango blended jam

Treatment	Storage period (months)	TSS (ºBrix)	Acidity (%)	Reducing sugars (%)	Total sugars (%)	Anthocyanins (mg/100g)	Tannins (mg/100 mL)	Iron (mg/100g)	Phosphorus (mg/100g)
T_1(55:00:: Jamun:Mango)	0	68.00	0.4	20.22	56.14	66.40	160.08	0.59	10.48
	2	68.50	0.48	22.47	56.26	64.70	160.06	0.56	10.47
	4	68.80	0.53	24.15	56.34	58.20	160.03	0.55	10.48
	6	70.50	0.57	27.26	56.46	54.50	160.01	0.53	10.47
T_2(50:05::Jamun: Mango)	0	68.00	0.4	20.42	55.24	62.20	158.88	0.55	10.65
	2	68.60	0.46	22.83	56.26	58.20	158.86	0.53	10.64
	4	70.20	0.49	24.23	56.36	55.40	158.83	0.52	10.63
	6	70.70	0.52	27.40	56.56	53.80	158.81	0.51	10.62
T_3(45:10:: Jamun: Mango)	0	68.00	0.4	20.46	55.44	56.20	158.56	0.49	10.79
	2	68.80	0.44	22.54	55.54	55.30	158.56	0.48	10.79
	4	70.60	0.47	24.04	55.56	54.50	158.55	0.47	10.78
	6	71.20	0.51	26.64	55.58	53.50	158.55	0.45	10.77
T_4(40:15:: Jamun: Mango)	0	68.00	0.4	20.52	56.46	55.40	158.36	0.45	10.87
	2	68.70	0.44	22.87	55.64	52.20	158.34	0.43	10.84
	4	70.70	0.48	24.57	55.76	51.10	158.33	0.43	10.83
	6	71.50	0.54	27.83	55.94	48.80	158.31	0.41	10.82
T_5(35:20:: Jamun: Mango)	0	68.00	0.4	20.56	56.66	54.20	158.25	0.43	10.95
	2	68.80	0.45	22.98	55.74	51.80	158.23	0.42	10.92
	4	70.90	0.51	24.81	56.86	49.80	158.20	0.42	10.88
	6	71.70	0.54	27.52	56.96	48.20	158.18	0.41	10.86

They further reported that the decrease was more extensive than that of total phenolics, which might result in colour quality loss in jams. 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. (Rhim, 2002) reported that the destruction in anthocyanin content in cherry, plum and mulberry jams was largely due to cooking at higher temperature for longer time. 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). Hydrolysis of the glycoside linkage is known to be the Ist step of anthocyanin degradation though no clear mechanism is available on the destruction of anthocyanins during thermal processing (Rhim, 2002).

Tannin

The Tannins are well known to have their influence on the flavor of the product as they are astringent in taste. The present study revealed that during storage of six months the tannin content as mg tannic acid decreased. As for as the overall effect of treatments were concerned the tannin content of all the treatments differed significantly when compared with each other. The decrease in tannin content during storage might be due to the formation of precipitates with organic constituents. Similar trend of decrease in Tannin content have also been reported by Kannan and Thirumaran (2004) in jamun jam, by Sharma *et al*. (2008) in Guava and papaya blended ready to serve beverage which they attributed due to oxidation of tannin during storage.

Minerals

Both iron and phosphorus contents of different blends of jamun-mango jams decreased with the advancement of storage. Table 1 showed that the treatments significantly influence the minerals content of blended jams. Vidhya and Narain (2010) while developing preserved products (Jam and fruit bar) from wood apple reported that there was a loss of phosphorous to the extent of 3.12, 5.11 and 8.80 percent in jam and 3.36, 5.81 and 10.7 percent in fruit bar on 30, 60 and 90 days of storage, respectively. The possible reason for the decrease might be due to its heat sensitiveness even at the ambient temperature which causes the destruction of minerals during storage.

Microbiological quality of Jamun-Mango blended jam

No microbial load was detected upto four months in jamun-mango blended jam. But after six months of storage a microbial count of (1×10^6 CFU per ml) was observed in treatment T_1 (55:0: jamun-mango) and T_5 (35:20: jamun-mango) which falls in acceptable zone. An acceptable count of microbes were also observed in wood apple jam and fruit bar at the end of storage period (Vidhya and Narain, 2010). Some of the samples of chyawanprash showed the presence of microbial count with in limit. From the studies, it can be concluded that the microbial growth is due to genera Bacillus as a common contaminant which may be from air (Polshettiwar *et al*., 2008).

Sensory evaluation of jamun-mango blended jam

Both body and colour scores of different treatment decreased during storage. Similar finding were reported by Shakir *et al*. (2008) in apple - pear mixed fruit jam, Kannan and Thirumaran (2004) in jamun jam and Hussain and Shakia (2010) in apricot-apple jam. The decline in colour scores could be attributed to non enzymatic browning and oxidation of phenolic compounds.

Flavor and Overall acceptability score of different treatments also decreased. Similar findings with respect to flavor were also reported by Prasad and Mali (2006) in ber jam, Raiz *et al*. (1999) in strawberry jam and Sogi and Singh (2001) in kinnow jam. There finding correlates with the findings of present

Table 2: Effect of treatments and storage period on organoleptic score of jamun mango blended jam

Treatment	Storage period (months)	Body	Colour	Flavor/aroma	Overall acceptability
T_1(55:00:: Jamun:Mango)	0	7.54	7.72	7.20	7.56
	2	7.42	7.54	7.14	7.44
	4	7.16	7.34	7.04	7.22
	6	7.34	7.25	7.00	7.04
T_2(50:05::Jamun: Mango)	0	7.66	7.66	7.42	7.62
	2	7.56	7.46	7.26	7.46
	4	7.48	7.26	7.20	7.36
	6	7.44	7.16	7.16	7.16
T_3(45:10:: Jamun: Mango)	0	8.74	8.66	8.64	8.74
	2	8.24	8.54	8.44	8.54
	4	7.85	8.26	8.14	8.00
	6	7.84	7.80	7.96	7.84
T_4(40:15:: Jamun: Mango)	0	8.52	7.64	7.86	7.54
	2	7.74	7.28	7.54	7.36
	4	7.16	7.24	7.42	7.20
	6	7.46	7.06	7.00	7.06
T_5(35:20:: Jamun: Mango)	0	8.46	7.84	7.44	7.64
	2	7.36	7.66	7.24	7.44
	4	7.08	7.57	7.16	7.25
	6	7.24	7.24	7.04	7.15

Table 3: Total microbial count of jamun -mango blended jamduring different storage periods

Treatment	Total number of colonies (cfu/mL)			
	0 month	2 months	4 months	6 months
T_1(55:00::Jamun: Mango)	0	0	0	1×10^6
T_2(50:05::Jamun: Mango)	0	0	0	0
T_3(45:10:: Jamun:Mango)	0	0	0	0
T_4(40:15:: Jamun:Mango)	0	0	0	0
T_5(35:20::Jamun:Mango)	0	0	0	1×10^6

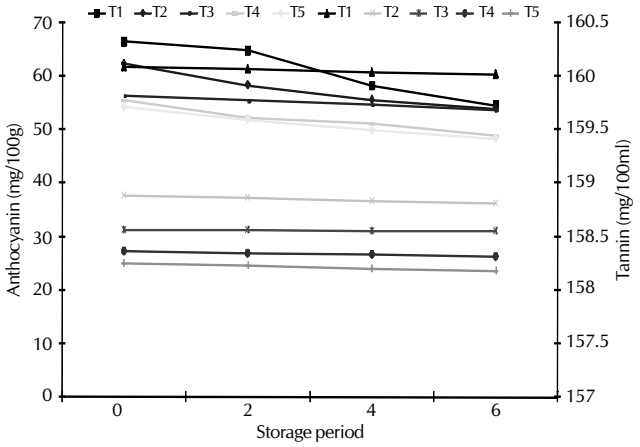

Figure 1: Effect of treatments and storage period on anthocyanins (mg/100g) and Tannins (mg/100mL) of jamun- mango blended jam

investigation.

Cost of production

The cost of production of jamun- mango blended jam comes to Rs 43.67/450gm. The calculated cost of jamun- mango blended jam was much less as compared to market brands.

Summary and Conclusion

Studies conducted on different treatment combination of jamun mango on quality and storability of jam shows that T_3(45:10::jamun:mango) was adjudged the best by way of retaining the maximum anthocyanin content after 6 months of storage. The same treatment scored maximum points for aroma, body, colour and overall acceptability after 6 months of storage.

CONCLUSION

Following conclusion are drawn from the present study. There is a scope of developing new products by blending different fruit pulps which help in improving the nutrient contents and reducing cost of production by using cheaper fruits in the blends.

The fruits which are nutritrious but are not accepted due to poor taste, flavour or tartness can be blended with other fruits to improve their acceptability.

Pulp of jamun and mango fruits can successfully be blended in the ratios of 45:10 for the development of jams respectively.

The products developed are cheaper as compared to locally available products.

Thus the investigation highlighted the technology for the development of quality products from underutilized fruit of jamun which otherwise goes waste. For enhancing the taste and nutrient content of jamun juice and mango pulp can be blended in different ratios for the development of various value added products.

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