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Preparation of bael preserve and its quality evaluation during storage

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ABSTRACT

The Present investigation was conducted to prepare the bael preserve and quality evaluation during storage at RRSS, Raya, SKUAST-J, Samba. The treatments namely T_1 (60 ^{0}Brix), T_2 (65 ^{0}Brix), T_3 (70^{0}Brix), T_4 (75^{0}Brix) and T_5 (80 ^{0}Brix) were used for preparation of bael preserve. Bael preserve was packed in glass bottles and stored at room temperature and subjected to chemical and sensory evaluation at an interval of one month for a period of three months.With the advancement of storage period an increasing trend was observed in reducing and total sugar and maximum values were recorded under three months storage period. The values of these sugars also increased significantly with increasing values of ^{0}Brix and maximum values were recorded with 80^{0}Brix. On the other hand a decreasing trend was noted in ascorbic acid with the increasing storage period and ^{0}Brix values.The best colour, flavour, taste and overall acceptability were found under treatment T_3 (70^{0}Brix) and minimum in T_1(60^{0}Brix). A decreasing trend during three month of storage was recorded in all parameters of organoleptic quality. The interactions also had significant effect on these parameters.

INTRODUCTION

Bael (*Aeglemarmelos* Corr.) is an indigenous fruit of India belongs to family Rutaceae and commonly known as Bengal quince, Indian quince, Golden apple, Holy fruit, Bel, Belwa, Sriphal, Stone apple and Maredo in India. Bael fruit is a sub-tropical, deciduous tree and fruit is globuse with grey or yellowish hard woody shell. Inside this, there is soft yellow or orange coloured mucilaginous pulp with numerous seeds. It has numerous seeds, which are densely covered with fibrous hairs and are embedded in a thick, gluey, aromatic pulp.Bael fruit is highly nutritive with a great medicinal use and the richest source of riboflavin. Gehlot and Dhawan (2005) reported about all parts of the trees *viz*. root, bark, leaves, flowers or fruits are used for curing one or other human ailment. The roots are sweet, astringent, bitter and febrifuge. They are useful in curing dyspepsia, dysentery, diarrhoea vitiated condition of vata, vomiting, cardiopalmus, stomachalgia, intermittent fever, seminal weakness, swelling, uropathy and gastric irritability in infants. The bark decoction for malaria and leaves are useful in opthalmia, deafness, diabetes and asthmatic complaints. The flowers allay thirst vomiting. The unripe fruits are acrid, astringent, bitter, digestive, sour, stomachia and are useful in dysentery-diarrhoea and stomachalgia. The ripe fruits are sweet, aromatic, cooling, febrifuge, laxative, good tonic for heart and brain and cure dyspepsia. Bael has a high tannin content which makes it an effective cure for dysentery and cholera. There is asmuch as 9% tannin in the pulp of wild fruits, less in the cultivated types and rind contains up to 20 per cent. It can be processed into delicious products like candy, squash, toffee, slab, pulp, powder and nectar. Therefore, preserve is prepared from this fruit to increase the utilization of unripe bael fruit among people. This paper reports on the feasibility for the development of value added product (bael preserve) in order to minimize the wastage, to promote the product as export item and to uplift the nutritional and socio-economic status of rainfed areas.

MATERIAL AND METHODS

The half cut fruits of green bael along with seeds were sliced into suitable size of pieces for preparing product with the help of a cutter machine. The peeled fruits were sliced crosswise into the pieces of about 2 cm thickness and then washed with water. The slices were pricked at both sides with stainless steel forks and blanched in boiling water for 5 min or until they become soft. The product was prepared with the combination of sugar syrup, citric acid and then slices were steeped in sugar syrup of 40^{0}brix for 24 hours. The pieces were drained out and the strength of syrup was raisedupto 60^{0}brix and kept the slices for 24 h after that strength of syrup was raisedfrom 60^{0}brix to 80^{0}brix and add 100ppmof potassium

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meta-bisulphite (KMS). At different concentration slices were steeped for a week. The treatments used to prepare the bael preserve were 60^0, 65^0, 70^0, 75^0 and 80^0 Brix. The sliceswere packed with sugar syrup in glass bottle and sealed airtight. The product was stored at room temperatureand subjected to chemical and sensory evaluation at an interval of one month for a period of three months.Reducing sugar, total sugar andascorbic acid content was estimated by Ranganna, 1986. The sensory evaluation of bael preserve was carried out by a panel of 10 judges. The bael preserves evaluated for various sensory quality attributes like colour, flavour, taste, and overall acceptability. Sensory evaluation method (Amerine *et al.* 1965) was adopted with a 9 point hedonic scale. The data obtained were statistically analysed using CRD factorial for interpretation of results through analysis of variance. Data was compared at 5 per cent level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Reducing sugar

The data (Table 1) showed the effect of various treatments and storage period on reducing sugar of bael preserve. Treatment (T_5) recorded the maximum value (14.24%) of reducing sugars duringfirst month of storage, while minimum value (9.13%) was recorded in T_1.At three months of storage, maximum value of reducing sugar was recorded in T_5(18.36 %) and minimum (12.24%) in T1. With increase in the storage period, there was a significant increase in the reducing sugars in all the treatments.The reducing sugars were found to increase with the advancement of the storage period. This increase might be due to hydrolysis of non-reducing sugars into reducing sugars.The results were in conformity with the findings reported byDamame*et al.*, 2002 in aonla.The interaction effect between the treatments and storage period was also found to be significant.

Total Sugar

There was a significant increase in the total sugar content of bael preserve from initial month of storage (24.44%) tothree months of storage (30.18%). After three months of storage, treatment T_5recorded highest value of (34.28) per cent of total sugar followed by T_4 (32.36per cent).Among the treatments, the maximum total sugars (30.94 %) was observed in treatment $T_5$and minimum (23.65%) in treatmentT_1 (Table 1). The interaction effect between treatments and storage was found to be significant.This was supported by Giraldo*et al.* (2003), who reported that the increase in concentration of sucrose solution gave rise to sugar during osmotic dehydration of mango. The increase in total sugar content during storage was also observed in jack fruit by Prasannath and Mahendran (2009).

Table 1: Effect of treatments and storage period onreducing and total sugar of bael preserve

Treatments	Reducing Sugar					Total Sugar				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1: 60^0 Brix	8.92	9.13	11.26	12.24	10.39	21.52	22.35	24.32	26.42	23.65
T_2: 65^0 Brix	10.12	12.24	13.65	15.23	12.81	22.68	24.36	25.16	27.34	24.89
T_3: 70^0 Brix	10.76	12.16	13.70	16.12	13.19	24.43	26.32	28.12	30.52	27.35
T_4: 75^0 Brix	11.54	13.04	15.30	17.12	14.25	25.74	27.30	29.42	32.36	28.71
T_5: 80^0 Brix	12.67	14.24	15.32	18.36	15.15	27.82	29.10	32.56	34.28	30.94
Mean	10.80	12.16	13.85	15.81		24.44	25.89	27.92	30.18	
CD (P=0.05)	Treatment 0.02,Storage 0.02, TxS0.03					Treatment 0.02,Storage 0.02,TxS 0.03				

Ascorbic acid

There was a significant variation among the treatments in respect of ascorbic acid content (Table 2). There was a significant decline in the ascorbic acid content of bael preserve from initial month of storage (2.25 mg/100g) to three months of storage (1.98 mg/100g). Among the mean treatments, the maximum retention of ascorbic acid content (2.47mg/100g) was observed in treatment $T_1$and minimum (1.59 mg/100g) in treatment T_5. Loss of

ascorbic acid might be due to its oxidation to dehydroascorbic acid followed by further degradation to 2, 3- diketogluconic acid and finally to furfural compounds which enter browning reactions. Similar result were also noticed by Sra *et al.* (2014) in dried carrot slices, Sharma *et al.*(2006) in dehydrated apple rings,

Table 2: Effect of treatments and storage periodon ascorbic acid of bael preserve

Treatments	Storage period (Months)				
	0	1	2	3	Mean
T_1: 60^0 Brix	2.74	2.54	2.36	2.25	2.47
T_2: 65^0 Brix	2.52	2.32	2.20	2.16	2.30
T_3: 70^0 Brix	2.36	2.30	2.18	2.15	2.25
T_4: 75^0 Brix	1.98	1.95	1.91	1.80	1.91
T_5: 80^0 Brix	1.65	1.60	1.57	1.54	1.59
Mean	2.25	2.14	2.05	1.98	
CD (P=0.05)	Treatment 0.02,Storage 0.02, TxS0.04				

Colour

Colour score of bael preserve decreased significantly during entire storage period (Table 3). At initial month of storage, maximum and the minimum colour scores recorded in T_3 and T_1, were 8.35 and 6.50, respectively. Whereas after three months, the maximum and the minimum colour score recorded by T_3 and T_1, were 7.90 and 6.10, respectively. On assessing the mean score evaluation of colour declined slightly during three months of storage period. All treatments of bael preserve differed significantly with each other in respect of color score.The decrease in colour scores during storage may be attributed to residual activities of polyphenolase and oxidative type of deterioration resulting from chemical reactions.Similar results have been reported by Durrani *et al.* (2011) in honey based carrot candy and by Shamrez *etal.* (2013) in citron peel.

Table 3: Effect of treatments and storageperiod on colour and flavour of bael preserve

Treatments	Colour					Flavour				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1:60^0Brix	6.50	6.40	6.20	6.10	6.30	6.30	6.20	6.10	5.90	6.13
T_2: 65^0Brix	7.50	7.35	7.25	7.18	7.32	7.00	6.90	6.85	6.75	6.89
T_3: 70^0Brix	8.35	8.20	8.06	7.90	8.13	8.25	8.10	8.05	7.95	8.09
T_4: 75^0Brix	8.00	7.90	7.70	7.50	7.78	7.90	7.85	7.80	7.75	7.83
T_5: 80^0Brix	7.00	6.90	6.70	6.55	6.79	6.95	6.90	6.70	6.62	6.79
Mean	7.47	7.35	7.18	7.05		7.28	7.19	7.10	6.99	
CD (P=0.05)	Treatment 0.03,Storage 0.03, TxS0.06					Treatment 0.02,Storage 0.02, TxS0.03				

Flavour

The data (Table 3) revealed that the maximum score of 8.25 was recorded in T_3 (70^0 Brix) followed by 7.90 inT_4 (75^0Brix) at initial day of storage. After 90 days of the storage period, the valueof 7.95 was recorded in T_3 (60^0Brix) followed by T_4(75^0Brix).The mean value of treatments varied significantly and the highest mean score of 8.09was registered in T_3 and 7.83inT_4. During storage period, there was a significant decrease in the mean flavour score from7.28at initial day to6.99after 90 days of storage period.Similar results have been reported by Bhattacherjee *et al.* (2012) in aonla candy and by Shamrez *et al.* (2013) in citron peel.

Taste

The mean score of judges for taste significantly decreased from 7.67 to 7.19 during storage (Table 4). The mean scores for taste in bael preserve on initial month of storage ranged from 6.70 to 8.50. Maximum mean taste score (8.21) was observed in treatment T_3 (70^0 Brix),

followed by treatment T_4 and minimum (6.44) in T_1.The interactioneffect between treatments and storage was found to be significant (Table 4) and maximum values was recorded under 70^0Brix and three months storage period. The results showed a loss of taste which might be due to the degradation of ascorbic acid and furfural production. Similar observations of decrease in taste score was also reported by Zambare *et al.* (2009) in wood apple RTS beverage.

Table 4: Effect of treatments and storage periodon taste and overall acceptabilityof bael preserve

Treatments	Taste					Overall acceptability				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1:60^0Brix	6.70	6.55	6.30	6.22	6.44	6.35	6.30	6.22	6.10	6.24
T_2: 65^0Brix	7.70	7.50	7.35	7.21	7.44	7.76	7.60	7.50	7.30	7.54
T_3: 70^0Brix	8.50	8.20	8.15	8.00	8.21	8.70	8.50	8.20	8.10	8.38
T_4: 75^0Brix	8.20	8.10	8.00	7.95	8.06	8.30	8.10	8.00	7.96	8.09
T_5: 80^0Brix	7.25	7.10	7.00	6.59	6.99	7.40	7.25	7.16	7.00	7.20
Mean	7.67	7.49	7.36	7.19		7.70	7.55	7.42	7.29	
CD (P=0.05)	Treatment 0.02,Storage 0.02, TxS0.03					Treatment 0.02,Storage 0.02, TxS0.03				

Overall acceptability

The data pertaining to score of overall acceptability revealed that at initial day of storage, the highest score of 8.70 was recorded in treatment T_3 (70^0Brix) followed by8.30 in treatment T_4 (Table 4). After 90 days of storage, the values decreased to 8.10 in $T_3$and 7.96 in T_4. The mean value of treatments varied significantly and the highest mean score of8.38 was assigned to $T_3$and the lowest (6.24) in T_1. During storage period, there was significant decrease in mean score from 7.70at initial day of storage to 7.29 at the end of 90 days of storage period. The effect of interaction between treatment and storage period was found to differ significantly at 5% level of significance. Kumar and Sagar (2010) observed a decreasing trend in overall acceptability sensory score of osmo dehydrated guava slices with increase in storage period of six months. Panwar*et al.* (2013) reported a decrease in overall acceptability of intermediate moisture aonla segments during six months of storage.

From the present study, it can be concluded that the bael preserve prepared from 70^0 Brix (T_3) was best on the basis of sensory evaluation. Instead of having high nutritional properties bael is still being used only by unorganized sector and is not being given much emphasis for its commercial utilization in term of value added products.

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