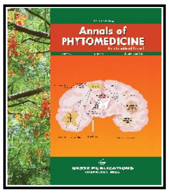
Annals of Phytomedicine 12(1): 717-723, 2023

DOI: http://dx.doi.org/10.54085/ap.2023.12.1.106

Annals of Phytomedicine: An International Journal
http://www.ukaazpublications.com/publications/index.php

Print ISSN : 2278-9839 Online ISSN : 2393-9885



Original Article : Open Access

Preparation and storability study of lime blended bael, *Aegle marmelos* (L.) Correa syrup under different storage conditions

Ashutosh Sudhir Dalal, Sandeep Kumar◆ and Patel Shubh Jitendrabhai
Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara-144411, Jalandhar, Punjab, India

Article Info

Article history
Received 25 May 2023
Revised 24 June 2023
Accepted 25 June 2023
Published Online 30 June-2023

Keywords
Aegle marmelos (L.) Correa
Blended syrup
Bael
Storage
Bioactive

Abstract

Bael fruit is not consumed in fresh form due to its hard shell, high astringency, mucilaginous texture, and numerous seeds resulting in fruit during harvesting time, is wasted due to limited use. However, there is a profitable potential for processing for admirable flavor, nutritive and therapeutic values of bael. The work on the processed form of bael in India is scanty. Consequently, preservation and preparation of bael-processed products such as lime blended bael syrup, ready-to-serve beverages, *etc*., is required. The experiment was set up using a factorial completely randomized design (F-CRD) with two factors. Factor "A" contains six levels of recipes, and Factor "B" makeup two storage conditions, S_1 (refrigerated storage) and S_2 (ambient storage), which are reproduced three times. As a result of the findings, it was found that the TSS and total sugars content of lime blended bael syrup were continuously increasing; however, the contents of titratable acidity and ascorbic acid were continuously decreasing with the progression of the storage period as a result of various modifications to the recipe, storage conditions, and their interactions. Among the various recipe treatments, significantly little differences in TSS (1.49^{0}B), titratable acidity (0.07%), total sugars (0.86%) and ascorbic acid (0.56 mg/100 ml) were noted from the initial to 120th day of storage when 30% pulp and 4% lime juice were combined to make bael syrup. Significantly, low variations in TSS (1.49^{0}B), titratable acidity (0.12%), total sugars (0.67%), and ascorbic acid (0.51 mg) were noticed among the interactions between recipes and storage conditions treatment of 30% pulp blended with 4% lime juice and stored under refrigerated condition.

1. Introduction

Bael botanically known as *Aegle marmelos* (L.) Correa, belongs to the family Rutaceae, an important indigenous fruit of India. The significance of bael fruit is found in its healing qualities, which elevate the tree to the status of one of India's most valuable medicinal plants. It is grown commercially for high economic return, therapeutic and nutraceutical value, and is suitable for marginal lands without much care (Vermal *et al*., 2018). Fruit is an excellent source of minerals, enzymes, and vitamins. They are easily digested and are good for blood purification and improving the digestive system. Blood purification is a favorable consequence of bael preservation. Additionally, this aids in lowering blood cholesterol levels and enhancing vision (Saloni *et al.,* 2022).

The bael fruit is rich and nutritious. It includes 61.5 g of water, 1.8 g of protein, 0.39 g of fat, 1.7 g of minerals, 31.8 g of carbs, 55 mg of beta-carotene, 0.13 mcg of thiamine, 1.19 mcg of riboflavin, 1.1 mcg of niacin, and 8 mcg of vitamin C per 100 g of edible part (Maskey *et al.,* 2018). No other fruit has such a high riboflavin concentration. Marmelosin is perhaps the therapeutically active compound of bael fruit. It has been inaccessible as a colorless crystalline compound (Maity *et al*., 2009). Among the flavoring compounds, terpene alcohol and β-ionone is considered to contribute to the aroma of bael. At optimum ripeness, fruit with excellent flavor content in large quantities of an isomeric compound of 2, 7-dimethyl-1,5,7-octatrein-3-ol. This compound is not observed in unripe bael fruit and appears to be important in making the bael flavor (Charoensiddhi and Anprung, 2008).

In India, there is fewer establishments of bael orchard due to their restricted cultivation and less demand for fruit in the market, and it is mainly grown near the temple, wild land, and home gardens. The tree grows wild in dry forests on hills and plains of central and southern India and Burma, Pakistan, and Bangladesh. The fruit is obtainable in almost all the states but is most plentifully available in Bihar, Uttar Pradesh, Orissa, and West Bengal.

The bael is native to the Indo-Malayan region and has been known in India since prehistoric times. The leaves of the tree are traditionally used as sacred offerings to 'Lord Siva' according to Hindu custom. In the Epic Ages, such as those of the Ramayana, bael fruit was known. Om found mention of the bael in the Vedas and also in early Buddhist and Jain literature (Sharma *et al*., 2007).

The fresh fruit of bael is usually not used for table purposes due to its high astringency, and off-flavor, and thus, fruit during their harvesting stage go to waste due to inadequate usage (Anurag *et al*., 2014). But, bael fruit has greatly probable in processed form. Thus, a scientific approach in the preservation and preparation of bael-processed products such as lime-blended bael syrup, ready-to-serve beverages, *etc.,* is required. Similarly, the merge information is available on changes that occur during the storage of bael beverages (Anurag *et al*., 2014).

Corresponding author: Dr. Sandeep Kumar
Assistant Professor, Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara-144411, Jalandhar, Punjab, India
E-mail: sandeep.28184@lpu.co.in
Tel.: +91-9782841870

Due to its hard shell, mucilaginous texture, numerous seeds, and extreme astringency, bael fruit is typically not consumed in its fresh form, and as a result, fruit during its peak harvesting season is wasted due to restricted use. However, with the excellent flavor, nutritive and therapeutic values of bael, there is a commercial potentiality for processing (Roy and Singh, 1979). The work on processed form of bael in this region is scanty. Moreover, earlier workers explored the possibilities of utilizing bael fruit beverages for the preparation of juice and syrup. Although, alone bael fruit juice and syrup prepared, have poor consumer acceptance. The blending of syrup helps to improve sensory properties. Lime blended bael syrup helps in boosting their nutritional quality in terms of riboflavin. Similarly, little information is available on changes that occurs during the storage of bael beverages (Gautam *et al*., 2020) Thus, research work on "preparation and storability study of lime blended bael syrup under different storage conditions" was undertaken. Also, storage of syrup under suitable storage conditions helps to increase the storage life of syrup and will be available throughout the year to the consumer without losing their nutritive value and it may be one of the solutions for lowering the enormous post-harvest losses in bael fruits.

In order for the syrup to be readily available to consumers all year long, real efforts must be made to research the recipes and storage for lime blended bael syrup as well as determine the best recipe and storage conditions.

2. Materials and Methods

An experiment was conducted from June, 2022 to October, 2022 at the Post Harvest Technology Laboratory of Lovely Professional University in Jalandhar, Phagwara with the goals of examining the storability of various lime blended bael syrup recipes, evaluating the chemical changes of the syrup under various storage conditions, and determining the best recipe. The experiment was set up by using a factorial completely randomized design (F-CRD) with two factors. Factor "A" contains six levels of recipes, including R_1 (25 per cent bael pulp plus 2 per cent lime juice), R_2 (25 per cent bael pulp plus 4 per cent lime juice), R_3 (30 per cent bael pulp plus 2 per cent lime juice), and R_4 (30 per cent bael pulp plus 4 per cent lime juice), R_5 (25%) and R_6 (30%) bael pulp, and Factor "B" makeup two storage conditions, S_1 (refrigerated storage 7 ± 1°C) and S_2 (ambient storage 32 ± 2°C), which were reproduced three times. Freshly made bael syrup and at 120th day of storage were analyzed for different biochemical changes, *viz.,* TSS, titratable acidity, total sugars, and ascorbic acid content.

Fully ripened bael fruit was selected for harvesting from the main garden, Department of Horticulture, Dr. P.D.K.V., Akola. The harvested fruits were washed thoroughly with tap water. Fruit pulp was extracted from fruits with the help of scooping, water was added to the pulp equal to the weight of the pulp, followed by mixing, heating at 80^{0}C for 1 min and then passing through muslin cloth to separate seeds and fiber. Thus, extracted pulp was used for preparation of lime blended bael syrup with following recipe:

Bael pulp	:	As per treatments
Lime juice	:	As per treatments
Sugar	:	2.5 kg per kg of pulp
Sodium benzoate	:	250 ppm

Bael syrup was filled into the pre-sterilized bottles of 200 ml capacity and sealed air tight using crown corks and were stored as per treatment for further observations.

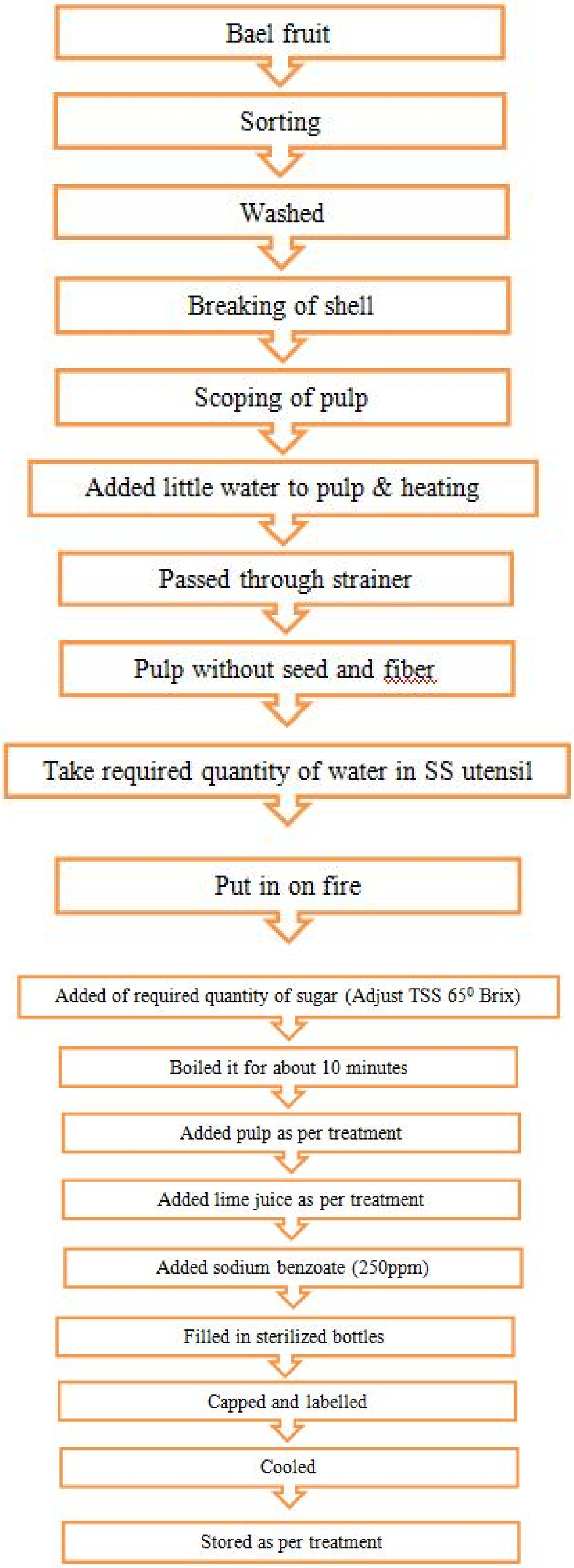


Figure 1: Flow sheet for preparation of lime blended bael syrup.

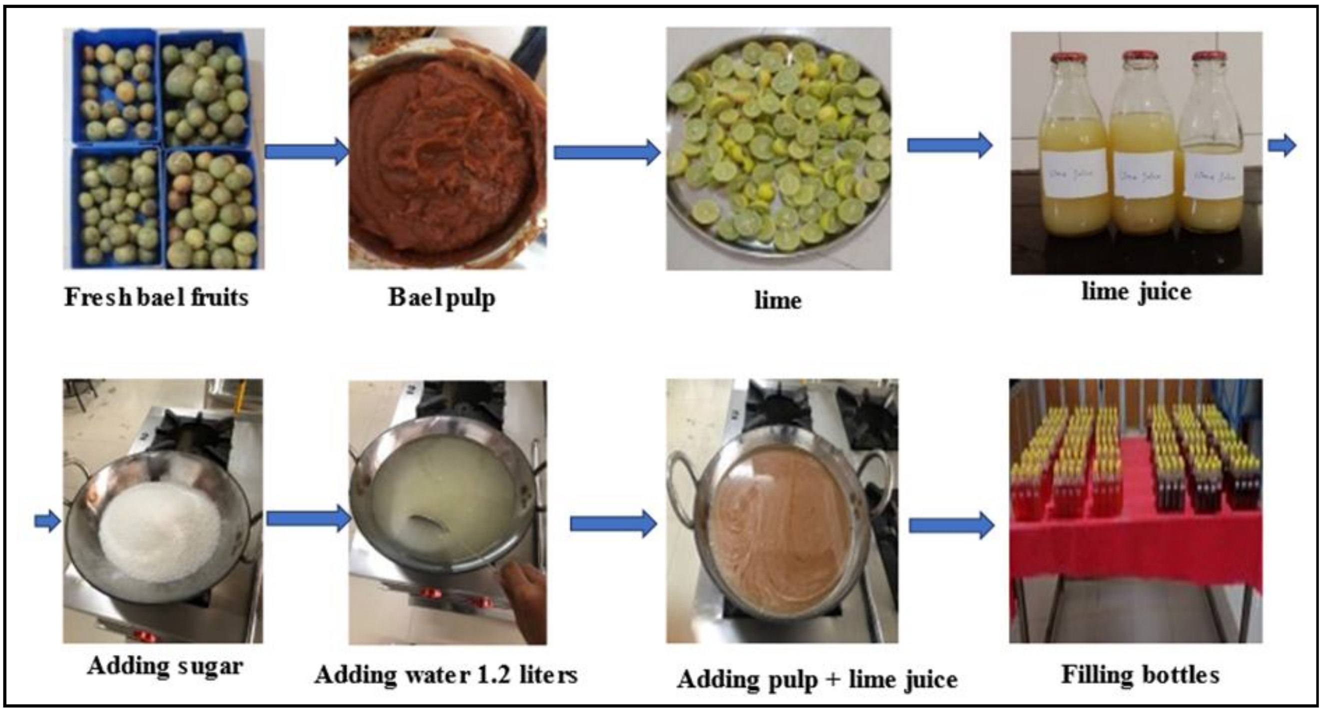


Figure 2: Preparation of lime blended bael syrup in the laboratory.

After the preparation of lime blended bael syrup as per treatments, the observations in respect of biochemical analysis during storage were recorded at preparation and after 120 days of storage.

2.1 Determination of total soluble solids

Total soluble solids were determined with the help of a digital portable refractometer (Hanna Instruments, Romania) and were expressed in degree Brix. A drop of bael syrup was placed on the clean prism of the refractometer and a displayed reading on a screen was taken directly (A.O.A.C. Official method of analysis 1997).

2.2 Determination of titratable acidity

Titratable acidity was determined by the procedure as reported (Sadasivam and Manickam, 1997) and titrated against 0.1 N NaOH solution using phenolphthalein as an indicator until permanent faint pink color developed. The acidity was calculated and expressed in terms of anhydrous citric acid as per cent .

Calculation

$$\text{Acidity (\%)} = \frac{\text{Titrevalue x Normality of NaOH x Volume made up x Eqt. Wt. of citric acid x 100}}{\text{Weight of the sample} \times \text{Volume of sample taken} \times 1000}$$

2.3 Determination of total sugars

For the determination of total sugars, 5 per cent phenol and 96 per cent concentrated sulphuric acid (H_2SO_4) were used to carry out analysis. The absorbance of the sample was noted at 490 mm and graph values were put in the formula to estimate the final value of total sugars (Ranganna, 1986).

Preparation of phenol sulphuric acid (PSA) for estimation of total sugars

i. 5% Phenol-5 g phenol dissolved in 95 ml distilled water.

ii. 96% H_2SO_4-add 96 ml conc. H_2SO_4 in 4 ml of distilled water.

Quantitative analysis of total sugar by using the spectrophotometer method

From above, 100 times diluted syrup, 1ml was taken in a 50 ml volumetric flask and made up the volume 50 ml with distilled water and from this, 1 ml was taken for further analysis of total sugars. 1 ml sample mixed with the 2 ml of phenol sulphuric acid reagent prepared earlier, stirred for 2-3 min and then absorbance of the samples was noted at 490 nm, and graph values were put in the following formula:

Total sugar %

$$= R \times \frac{1}{1000000} \times \frac{100 \times 50}{1} \times \frac{100}{\text{Wt. of sample taken (1.07)}}$$

% Total sugar = R x 0.4673 where R is Graph reading

2.4 Determination of ascorbic acid

The ascorbic acid content of bael syrup was estimated by the method described by Ranganna (1986). 10 ml of aliquot was taken and transferred to 100 ml volumetric flask and volume made up with 3 per cent metaphosphoric acid. From it, 10 ml aliquot was taken into 100 ml beaker and titrates against 2,6-dichlorophenol indophenol dye solution until the stable faint pink colour appeared for 10 sec. The result was expressed as mg of ascorbic acid/100 ml.

2.5 Statical analysis

The data obtained from each lot and each interval were collected in three replicates. The observed data were subjected to analysis of variance by the factorial completely randomized design (F-CRD) method as per the method suggested by Panse and Sukhatme (1989). The data was calculated by the tool OPSTAT software and the mean value of three replicates was presented (Sheoran *et al*., 1998).

3. Results

The data in admiration of total soluble solids, titratable acidity, total sugars, and ascorbic acid content of lime blended bael syrup as influenced by different recipes and storage conditions were recorded initially and at 120th day of storage are presented in Tables 1 and 2.

3.1 Effect of recipes on TSS, titratable acidity, total sugars and ascorbic acid content

Initially, different recipes exhibited significant differences in respect of titratable acidity and total sugars, however, TSS and ascorbic acid content in lime blended bael syrup were found non-significant. While, at 120th day of observation, TSS, titratable acidity, total sugars, and ascorbic acid contents were found significant as shown in Table 1.

In general, the total soluble solids and total sugar of lime blended bael syrup were gradually increased in all the treatments of recipes, while titratable acidity and ascorbic acid were decreased. Minimum increase in total soluble solids (from 65.00 to 66.49^{0}B) and total sugars (51.30 to 52.16%) and a minimum decrease in titratable acidity (1.51 to 1.34%) and ascorbic acid (15.38 to 14.82 mg/100 ml) at 120 days of storage were observed in treatment R_4 (30% bael pulp + 4% lime juice) which was significantly greater than rest of all treatments. However, the change in TSS (from 65.00 to 66.94^{o}B), titratable acidity (1.01 to 0.41%), total sugars (from 49.77 to 51.15%) and ascorbic acid (from 15.38 to 13.35 mg/100 ml) were found more in treatment R_6 (30 % bael pulp). Thus, a minimum total increase (1.49^{0}B) in total soluble solids and total sugars (0.86%) and minimum total decrease in titratable acidity (0.16%) and ascorbic acid (0.56 mg/100 ml) during 120 days of storage was noticed when bael syrup was prepared with 30 per cent pulp and blended with 4 per cent lime juice. The recipe found next in order in this regard was R_2 (25 % bael pulp + 4 % lime juice).

Table 1: Biochemical changes of lime blended bael syrup during storage due to recipe and storage conditions

Treatments	TSS (^{o}B)		Increase in TSS (^{o}B)	Titratable acidity		Decrease in acidity	Total sugars (%)		Increase in total sugars (%)	Ascorbic acid (mg/ 100 ml)		Decrease in ascorbic acid (mg/ 100 ml)
	Storage period (Days)			Storage period (Days)			Storage period (Days)			Storage period (Days)		
	Initial	120th		Initial	120th		Initial	120th		Initial	120th	
Recipe												
R_1-25% bael pulp + 2% lime juice	65.00	66.75	1.75	1.51	1.00	0.51	50.10	51.32	1.22	15.38	13.80	1.07
R_2-25% bael pulp + 4% lime juice	65.00	66.53	1.53	1.28	1.08	0.20	51.01	51.99	0.98	15.39	14.68	0.70
R_3-30% bael pulp + 2% lime juice	65.00	66.62	1.62	1.01	0.76	0.25	50.82	51.87	1.05	15.38	14.43	0.95
R_4-30% bael pulp + 4% lime juice	65.00	66.49	1.49	1.51	1.34	0.16	51.30	52.16	0.86	15.38	14.82	0.56
R_5-25% bael pulp	65.00	66.80	1.80	1.28	0.74	0.53	50.00	51.30	1.30	15.39	13.3	1.13
R_6-30% bael pulp	65.00	66.94	1.94	1.01	0.41	0.60	49.77	51.15	1.30	15.38	13.35	1.21
SE(m)±	0.002	0.013	0.010	0.012	0.012	0.014	0.007	0.010	0.004	0.007	0.006	0.009
CD at 5%	NS	0.038	0.029	0.037	0.036	0.041	0.021	0.031	0.012	NS	0.019	0.028
Storage conditions												
S_1-Refrigerated storage	65.00	65.71	0.71	1.35	0.99	0.35	50.50	51.45	0.95	15.38	13.96	1.42
S_2- Ambient storage	65.00	68.66	3.66	1.19	0.75	0.44	50.50	51.80	1.30	15.39	12.17	3.22
SE(m)±	0.001	0.007	0.006	0.007	0.007	0.008	0.004	0.006	0.002	0.004	0.008	0.005
CD at 5%	NS	0.022	0.017	0.021	0.021	0.024	NS	0.018	0.007	NS	0.023	0.016

***Three replications per treatment;** ** CD has been calculated based on value.

Table 2: Biochemical changes of lime blended bael syrup during storage due to interactions (Recipe x Storage conditions)

Treatments	TSS (°B)		Increase in TSS (°B)	Titratable acidity		Decrease in acidity	Total sugars (%)		Increase in total sugars (%)	Ascorbic acid (mg/ 100 ml)		Decrease in ascorbic acid (mg/ 100 ml)
	Storage period (Days)			Storage period (Days)			Storage period (Days)			Storage period (Days)		
	Initial	120th		Initial	120th		Initial	120th		Initial	120th	
Recipe												
R_1S_1-25% bael pulp + 2% lime juice + stored in refrigerate storage	65.00	66.57	1.57	1.04	0.81	0.23	50.10	51.18	1.08	15.39	14.50	0.89
R_2S_1-25% bael pulp + 4% lime juice + stored in refrigerate storage	65.00	66.50	1.50	1.52	1.35	0.17	51.01	51.82	0.81	15.39	14.86	0.52
R_3S_1-30% bael pulp + 2% lime juice + stored in refrigerate storage	65.00	66.53	1.53	1.51	1.29	0.21	50.82	51.68	0.86	15.38	14.76	0.62
R4S1-30% bael pulp + 4% lime juice + stored in refrigerate storage	65.00	66.46	1.46	1.52	1.40	0.12	51.30	51.97	0.67	15.39	14.88	0.51
R_5S_1-25% bael pulp + stored in refrigerated storage	65.00	66.60	1.60	1.01	0.77	0.24	50.01	51.12	1.11	15.38	14.46	0.92
R_6S_1-30% bael pulp + stored in refrigerated storage	65.00	66.64	1.64	1.01	0.75	0.26	49.77	50.98	1.21	15.39	14.41	0.98
R_1S_2-25% bael pulp + 2% lime juice + stored in ambient storage	65.00	66.86	1.86	1.04	0.47	0.57	50.10	51.46	1.36	15.39	14.22	1.17
R_2S_2-25% bael pulp + 4% lime juice + stored in ambient storage	65.00	66.75	1.75	1.52	1.02	0.50	51.01	52.25	1.24	15.39	14.30	1.09
R_3S_2-30% bael pulp + 2% lime juice + stored in ambient storage	65.00	66.81	1.81	1.51	0.96	0.55	50.82	52.11	1.29	15.38	14.27	1.11
R_4S_2-30% bael pulp + 4% lime juice + stored in ambient storage e	65.00	66.69	1.69	1.52	1.05	0.47	51.30	52.52	1.22	15.39	14.34	1.04
R_5S_2-25% bael pulp + stored in ambient storage	65.00	66.92	1.92	1.01	0.42	0.59	50.01	51.49	1.48	15.38	14.20	1.17
R_6S_2-30% bael pulp + stored in ambient storage	65.00	66.97	1.97	1.01	0.40	0.61	49.77	50.33	1.56	15.39	14.14	1.25
SE(m)±	0.009	0.008	0.008	0.013	0.015	0.005	0.010	0.015	0.006	0.003	0.006	0.004
CD at 5%	NS	0.024	0.024	0.037	0.044	0.015	NS	0.043	0.017	NS	0.018	0.011

***Three replications per treatment;** ** CD has been calculated based on value.

3.2 Effect of storage conditions on TSS, titratable acidity, total sugars, and ascorbic acid content

Initially, different storage conditions showed non-significant differences in respect of TSS, total sugars, and ascorbic acid; however, titratable acidity was found significant. While, at 120th day of storage, data in these respects were found significant as shown in Table 1.

In both storage circumstances, the total soluble solids and total sugars of the lime-blend syrup rose during the course of the 120th-day storage period while titratable acidity and ascorbic acid content were decreased. The changes in the total soluble solids (from 65.00 to 65.71°B), titratable acidity (from 1.35 to 0.99%), total sugars (from 50.50 to 51.45%) and ascorbic acid (15.38 to 13.96 mg/100 ml) of lime-blended bael syrup after 120 days of storage were found to be significantly minimum at refrigerated storage conditions as compared to ambient storage conditions**.**

3.3 Interaction effect of recipes and storage conditions on TSS, titratable acidity, total sugars, and ascorbic acid content

The information is given in Table 2 shows how interactions of different recipes and storage circumstances affect the TSS, titratable acidity, total sugars, and ascorbic acid content of lime blended bael syrup.

An interaction effect of recipes and storage conditions on total soluble solids, titratable acidity, total sugars and ascorbic acid content of lime blended bael syrup was found to be significant at all stages of observation except at initial stage in TSS and total sugars where these were found to be non-significant. In general, the lime blended bael syrup stored at refrigerated and ambient storage conditions (32 ± 2°C) remained better without spoilage up to 120 days of storage. The lime blended bael syrup prepared from different recipes and stored in refrigerated storage showed less biochemical changes at 120 days of storage as compared to store in ambient conditions. Less change in total soluble solids (1.46°B), titratable acidity (0.12%), total sugars (0.67%) and ascorbic acid (0.51 mg/100 ml) of bael syrup was observed in treatment combination R_4S_1 (30% bael pulp blended with 4% lime juice and stored in refrigerated storage conditions). It was followed by treatment combination R_2S_1 (25% bael pulp blended with 4% lime juice and stored in refrigerated storage conditions). However, significantly maximum changes in total soluble solids (1.75°B), titratable acidity (0.61%), total sugars (1.56%) and ascorbic acid (1.25 mg/100 ml were noticed with the treatment combination R_6S_2 (30% bael pulp stored in ambient storage conditions) and it was followed by treatment combination R_5S_2 (25% bael pulp stored in ambient storage conditions).

4. Discussion

The rise in total soluble solids was generated by the hydrolysis of polysaccharides including starch, cellulose, and pectin into simple substances, which also increased the level of soluble solids and total soluble sugars. This suggests that the pulp's composition changed during storage (Reddy and Chikkasubbanna, 2009); this shift may have been brought on by the conversion of polysaccharides to simple sugars. The findings of numerous researchers are consistent with the results presented above. The growth in TSS in carrot pulp during storage was slower in a low-temperature, cool environment than it was at room temperature. According to (Deka *et al.,* 2005), the TSS of pomegranate squash rose during storage. This could be the result of starch, cellulose, and pectin stuff being hydrolyzed into a simple substance (Srinivas *et al*., 2007).

As expected, an increase in storage temperature and time, caused a decrease in acidity. This decrease in acidity of lime blended bael syrup during storage might be attributed to hydrolysis of polysaccharides and non-reducing sugars where acid is utilized for converting them to hexose sugars (reducing sugars). The declining trend might also be due to chemical interaction between the chemical constituents of juice induced by temperature influencing enzymatic action (Palaniswamy and Muthukrishnan, 1974). The findings discovered the same trend of results in guava RTS juice after storing for sixty days at room temperature (Rashid *et al.*, 2018). The degree of reduction in acidity is dependent on the concentration of sugar and is a general phenomenon during storage of beverages in the presence of sugars (Bhatia *et al.,* 1986) The partial hydrolysis of complex carbohydrates into simple sugar may be the cause of the decrease in acidity of jamun products (Kannan and Thirumaran, 2002).

Starch and pectin were likely converted into simple sugars during storage, which led to a rise in the overall sugar content of lime blended bael syrup. A similar tendency in the results was discovered in guava RTS and they reported that, overall sugar concentration gradually increased at room temperature (Rashid *et al.*, 2018). The rise in total soluble solids and the rise in total sugars were correlated. The conversion of starch and pectin into simple sugars was likely the cause of the elevated amount of total sugars. With the development of storage, they observed an increasing trend in kinnow squash (Sogi and Singh, 2001) The amount of total sugars in aonla squash increased slightly, from 45.54 to 46.75%. They added that partial hydrolysis of complex carbohydrates may be to blame, and that acidity and high temperatures may have hastened the process (Jain *et al.*, 2006).

While lime blended bael syrup held in a refrigerator did not show any discernible loss of ascorbic acid, an increase in storage temperature and time of storage led to a drop in ascorbic acid retention. Since ascorbic acid is extremely sensitive to heat and pressure treatment, oxidation, and light, the decrease in ascorbic acid concentration may be caused by thermal degradation during processing and subsequent oxidation in storage. Throughout the three months of ascorbic acid storage of aonla juice, there was a loss of 77.31% at ambient temperature and a loss of 51.9% in a refrigerator (Reddy and Chikkasubbanna, 2009). The ascorbic acid content of jack fruit squash packed under various procedures decreased continuously, with the rate of loss being greatest at 37°C and lowest at 2-5°C sugars (Bhatia *et al.*, 1986). Ascorbic acid levels in aonla syrup decreased during the course of a 90 day storage period (Reddy and Chikkasubbanna, 2009).

5. Conclusion

From the results, it can be concluded that the TSS and total sugars content of lime blended bael syrup made by using various recipes increased steadily as storage time increased. When lime blended bael syrup was made with 30% bael pulp and 4% lime juice and stored under refrigeration, there was the least amount of increase in TSS and total sugars. The contents of ascorbic acid and titratable acidity constantly declined during the course of the progressive storage duration of various lime-blended bael syrup recipes. In comparison to ambient storage, the rate of reduction was lowest in a refrigerator. The amount of titratable acidity and ascorbic acid significantly decreased when lime juice was added to bael syrup, which was made from 30% bael pulp and 4% lime juice. The preparation of lime blended bael syrup will help to earn remunerative prices by growers for their produce during the glut and off-season. Also, storage of syrup under suitable storage conditions help to increase the storage life of syrup and will available throughout the year to the consumer without losing their nutritive value. It is crucial to transform the fruit into different value-added products and it may be one of the solutions for lowering the enormous post-harvest losses in bael fruits.

Acknowledgments

The authors would like to thank of Lovely Professional University, Punjab for providing infrastructure and research opportunities.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

References

A.O.A.C. (1995). Official method of analysis. Association of Official Analytical chemists, Washington, D.C. **16**:37.

Anurag, S.; Pragati, K. and Ashutosh, U. (2014). Bael (*Aegle marmelos* L. Correa) products processing: A review. African Journal of Food Science, **8**(5):204-215.

Bhatia, B. S.; Siddappa, G. S. and Girdharilal. (1986). Physicochemical changes in jack fruit squash during storage. The Ind. J. Agril. Sci., **24**(4):405-413.

Charoensiddhi, S. and Anprung, P. (2008). Bioactive compounds and volatile compounds of Thai bael fruit (*Aegle marmelos* (L.) Correa) as a valuable source for functional food ingredients. Int. Food Res. J., **15**(3):287-295.

Deka, B. C.; Sethi, V. and Saikia, A. (2005). Changes in quality of mango-pineapple spiced beverage during storage. Ind. J. Hort., **62**(1):71-75.

Gautam, A.; Dhiman, A. K.; Attri, S. and Kathuria, D. (2020). Formulation and storage studies of herbal based RTS beverages from persimmon (*Diospyros kaki* L.) fruit. Ann. Phytomed., **9**(2):155-163.

Jain, V.; Singh, P. and Singh, A. K. (2006). Screening of aonla cultivars for making squash. Indian J. Arid Hort., **1**(1):44-46.

Kannan, S. and Thirumaran, A. S. (2002). Studies on storage behavior of Jamun product. Beverage and Food World, **29**(3):32-33.

Maity, P.; Hansda, D.; Bandyopadhyay, U. and Mishra, D. K. (2009). Biological activities of crude extracts and chemical constituents of Bael, *Aegle marmelos* (L.) Corr. Indian Journal of Experimental Biology, **49**:849-861.

Maskey, B.; Dhakal, D.; Pradhananga, M. and Shrestha, N. K. (2018). Extraction and process optimization of bael fruit pectin. Food Science and Nutrition, **6**(7):1927-1932.

Palaniswamy, K. P. and Muthukrishnan, C. R. (1974). Studies on the physicochemical characters of lemon juices and squashes during storage. Indian Food Packer, **28**(4):37-41.

Panse, V.G. and Sukhatme, P.V. (1989). Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi.

Ranganna, S. (1986). Analytical methods and FPO specification in Handbook of Analysis and quality control for fruit and vegetable products. 2nd Ed. Tata Mcgraw- Hill Pub. Co., New Delhi. pp:1-101.

Rashid, R.; Bhat, A.; Dayal, A.; Sood, M. and Sharma, S. (2018). Studies on storage stability of guava RTS. The Pharma Innovation., **7**(5, Part D): 230.

Reddy, H. A. and Chikkasubbanna, V (2009). Studies on storage behaviour of amla syrup, The Asian J. Hort., **4**(1):5-9.

Roy, S. K. and Singh, R. N. (1979). Studies on utilization of bael fruit (*Aegle marmelos* L. Correa) for processing IV. storage studies of bael fruit product. Indian Food Packer, **33**:3-9

Sadasivam, S. and A. Manickam. (1997). Biochemical methods, New age International (P) Limited Publishers, Pune, pp:6-12.

Saloni, S. M.; Rai, D. C.; Panda, P. and Kumar, S. (2022). A comprehensive review on *Bacopa monnieri* (L.) Pennell (Brahmi): Utilization as a functional food ingredient and health-promoting attributes. Ann. Phytomed., **11**(1):142-150.

Sharma, P. C.; Bhatia, V.; Bansal, N. and Sharma, A. (2007). A review on Bael tree. Natural Product Radiance, **6**(2):171-178.

Sheoran, O. P.; Tonk, D. S.; Kaushik, L. S.; Hasija, R. C and Pannu, R. S (1998). Statistical Software Package for Agricultural Research Workers. Recent Advances in Information Theory, Statistics and Computer Applications by D.S. Hooda and R.C. Hasija Department of Mathematics Statistics, CCS HAU, Hisar pp:139-143

Sogi, D. S. and Singh, S. (2001). Studies on bitterness development in Kinnow juice, RTS, squash, jam and candy. J. Food Sci. Tech., **38**(5):433-438

Srinivas, K. N.; Revanna, M. L. and Jamuna, K. V. (2007). Standardization of recipes for production of squash in pomegranate (*Punica grantum* L.) cv. Ganesh and Mridula. J. Dairying foods and HS., **26**(2):133-136

Verma, S.; Gupta, M.; Popli, H. and Aggarwal, G. (2018). Diabetes mellitus treatment using herbal drugs. International Journal of Phytomedicine, **10**(1):1-10.

Citation **Ashutosh Sudhir Dalal, Sandeep Kumar and Patel Shubh Jitendrabhai (2023). Preparation and storability study of lime blended bael, *Aegle marmelos* (L.) Correa syrup under different storage conditions. Ann. Phytomed., 12(1):717-723. http://dx.doi.org/10.54085/ap.2023.12.1.106.**