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Standardization of a recipe for the preparation of candy from ber

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Abstract
An experiment was carried out at the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (Uttar Pradesh) during the year 2018. The experiment consisted of 9 treatments with 0.2% KMS (potassium metabisulphite), 0.2% citric acid with three different concentrations of sugar syrup (40º B, 50ºB, 60ºB). This investigation laid out in completely randomized design with three replications. Ber candy was stored for 80 days at ambient temperature. From storage studies, it was revealed that T_7 (Stepping in 40^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid) is most suitable treatment in terms of their physic-chemical properties, organoleptic test and cost benefit ratio (1: 1.994) of ber candy. On the basis of results it is concluded that treatment T_7 be used in commercialization of the ber candy. The results indicated that the quality observations and sensory evaluation affected by various treatments.

Keywords: Ber candy, KMS, citric acid, sugar syrup

1. Introduction
Ber (*Zizyphus mauritiana Lamk*.) is one of the most ancient and common fruit of India. It is an ideal fruit for cultivation in arid and semi-arid regions of India where most of other fruits cannot be grown either due to lack of irrigation facilities or adverse climatic conditions. It is indigenous to India belonging to family Rhamnaceae. It is one of the hardy fruit tree and cultivated in Northern parts of India especially in the states of Punjab, Haryana, Rajasthan, Uttar Pradesh and also in Maharastra and Gujrat. Total area under ber cultivation in India is around 61284 hectares (Bose *et al.*, 2001) [1].

Ber is a tropical and subtropical fruit native to the northern hemisphere. The family has 50 genera and more than 600 species of which the species *Z. jujube* Mill (Chinese jujube or Chinese date), *Z. mauritiana Lamk* (Indian jujube or ber) and *Z. spina christi* (L.) wild (Christ's thorn) are the most important in terms of distribution and economic significance. Ber is being cultivated on an estimated area of 22,000 hectares. The yield potential varies from one to two quintals per tree per annum. It is considered an underutilised fruit crop in semi-arid regions of the world and can be successfully cultivated in the marginal ecosystem of the subtropics and tropics (Pareek, 2001) [17].

Due to the surplus of fruits in the local markets during peak season, a substantial quantity goes to waste, resulting in heavy postharvest losses. A cost and returns analysis showed that ber production is highly remunerative but requires proper handling with respect to pre harvest and postharvest treatments, packaging, transportation, storage, postharvest pathology, processing, etc. Profits could be enhanced if efforts to increase production are supplemented with efforts to minimize postharvest losses and enhance shelf life. Ber fruits are usually stored at ambient/room temperature (25–35°C) from harvest until their consumption. (Panwar, 1981) [16] Reported that ber fruits remained in marketable condition for about one week. Ber fruits are within the reach of the poor people, hence rightly known as 'Poor man's apple' (Bal, 1982) [3].

Extensive studies have been carried out using ber fruits to prepare various processed products, such as candy (Gupta, 1983) [5], dehydrated products (Lande, 1999) [11], juice and wine (khurdiya, 1980), jam, jelly, shreds and powder (patil *et al.*, 1999) [18] With increased production of a particular fruit in a season, there is a glut in the market and the farmer is at loss due to low market price for his produce. This is also true in case of ber. It is therefore necessary to develop suitable technology for processing of the fruits. Thus the processing of ber into marketable demanded products likes, pulp, juice concentrates, jams, jelly, syrup, ber candy, ber powder, tutti-fruity, slices, shreds and wine will help to increase the shelf life, minimize the glut in the market during its peak season of production, reduces post-harvest

losses, enhances the export, which ultimately fetches the valuable foreign exchange and improves socioeconomic conditions of farmers. Among the different processes, candy making has been proved to be viable and appropriate for preparation of ber candy, much longer time is required.

Materials and Methods

An experiment was carried out at the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P) during the year 2018. Ber (cv. Umran) fruit of yellow colour, uniform sized brought from the surrounding fruit market in Allahabad for this experiment.

Procedure of preparation of ber candy

Mature ber fruits (cv. Umran) were selected and washed to remove the dust particles. Ber fruits were then plunged in boiling water as well as with sodium metabisulphite for 5-10 minute and then in cold water to stop the process of blanching. Destoning was carried out and slices were submerged overnight in sugar syrup of 40/50/60 ºBrix and 0.5 per cent citric acid for 24 hours. Then strength of sugar syrup was increased slowly at a constant rate of 10°Brix per day till the strength of sugar syrup reaches up to 70°Brix. After 48, the syrup is drained and ber slices are arranged in the trays as individual pieces and dried in tray drier at 60ºC for 5-6 hrs. The candy was cooled before packing in polyethylene bags or plastic boxes. (Kaikadi *et al.*, 2006) [9].

Treatment details

T_1 - Stepping in 40^0 B syrup
T_2 - Stepping in 50^0 B syrup
T_3 - Stepping in 60^0 B syrup
T_4 - Stepping in 40^0 B syrup + blanching in 0.2% KMS solution
T_5 - Stepping in 50^0 B syrup + blanching in 0.2% KMS solution
T_6 - Stepping in 60^0 B syrup + blanching in 0.2% KMS solution
T_7 - Stepping in 40^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid
T_8 - Stepping in 50^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid
T_9 - Stepping in 60^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid

Storage

Prepared ber candy of different treatments was then wrapped in polyethylene bags and kept in cool airtight boxes for storage and further analysis.

Sensory analysis of ber candy

For statistical analysis samples were evaluated for moisture, pH, TSS, acidity and sensory evaluation for colour, flavour, texture, taste and overall acceptability was performed by panel of 9 members. The samples were presented to 9 members. The members were asked to rate the different composition presented to them on a 9-point hedonic scale with the ratings of: 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much; and 1 = Dislike extremely. The result was analyzed by statistical software (statistics).

Results and Discussion

Total soluble solid (T.S.S.) (ºBrix)

The data on Total Soluble Solids (T.S.S.) for all treatments has been presented in (Table 1) T.S.S. of ber candy was found to increase with increase in storage duration. After 80 days of storage. The effect of treatments on TSS changes was observed significantly. Highest mean value for treatment was recorded in T_9 (72.62 ºBrix) while minimum score was recorded in T_1 (67.33 ºBrix). Increase in TSS with storage was also by Tandon *et al., (*2008) and Manivsagan (2011) in karonda candy.

TSS was found gradually increased with increase in storage period. This might be due to the conversion of polysaccharides into sugars during hydrolysis process. Increase in TSS might also be attributed to the reduction in moisture content of the product with storage.

Acidity

Acid gives the characteristic sourness to the product. Observations recorded for change in acidity were found highest (1.68) in treatment T_8 (Stepping in 50^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid) while lowest (0.85) was observed in T_1 (Stepping in 40^0 B syrup) The data is found to reveal statistically at 0, 20, 40, 60 and 80 days of storage The data regarding acidity in different treatments of this was gradual increase in acidity in all treatments during storage up to 80 days. Similar results found by Agarwal and sandhu (2006) [1] in kinnow candy and Nath *et al.* (2005) [15] in ginger-kinnow squash.

PH The pH has great importance to maintain shelf stability; pH can also influence the flavor and processing. Highest mean value for treatment was observed in T_3 (5.03) while the minimum value was observed in T_7 (4.06) during storage. Similar results were reported by Jain *et al.* (2004) [7] and Krishnaveni *et al.* (2001) [10] in jack fruit RTS.

Moisture content

The results of changes in moisture content of ber candy during storage. A significant decrease was observed in moisture content during total period of storage. For treatment, the highest mean was observed in T_9 (16.20) while minimum was recorded in T_2 (15.32).The decrease in moisture content may be due to evaporation during storage. Similar observations were also reported by Daisy and Gehlot (2006) [4] in Aonla preserve and Madhan and Dhawan (2005) [12] in carrot candy.

Overall acceptability

The results on changes in overall acceptability of ber candy during storage. The data was found statistically significant at 0, 20, 40, 60 and 80 days of storage. Overall acceptability was recorded of storage among the different treatments. The maximum score (8.38) was observed in T_7 (Stepping in 40^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid) followed by (7.80) T_9 (Stepping in 60^0 B syrup + blanching in 0.2% KMS solution + 1% citric acid) and minimum score (6.54) is observed in T_6 (Stepping in 60^0 B syrup + blanching in 0.2% KMS solution). However the organoleptic characters showed a gradual decrease during the storage period up to 80 days. This finding was in conformity with Hiremanth and Rokhade (2006) in sapota candy and Sharma (2013) [19] in apple candy.

Table 1: Change in T.S.S. and Acidity of ber candy during storage at ambient conditions

Treatments	T.S.S. (ºBrix)					Acidity				
	initial	20 days	40 days	60 days	80 days	initial	20 days	40 days	60 days	80 days
T_1	66.10	66.36	67.07	68.12	69.02	0.71	0.78	0.85	0.92	0.99
T_2	69.06	69.49	70.08	71.05	72.01	1.27	1.35	1.42	1.63	1.77
T3	69.80	69.99	70.21	71.19	72.12	1.20	1.28	1.35	1.49	1.70
T_4	66.23	67.03	68.22	69.03	70.23	0.78	0.85	0.92	0.99	1.20
T_5	68.06	69.23	70.19	71.11	72.33	1.35	1.42	1.49	1.63	1.77
T_6	70.06	70.31	71.04	71.91	72.52	1.28	1.35	1.42	1.56	1.92
T_7	66.03	66.60	67.15	68.31	69.61	0.92	0.99	1.14	1.35	1.42
T_8	69.10	69.46	70.43	71.45	72.47	1.42	1.49	1.63	1.77	2.13
T_9	70.20	70.42	71.32	71.59	72.62	1.13	1.21	1.28	1.42	1.49
F-test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed(±)	0.141	0.200	0.282	0.200	0.223	0.141	0.089	0.118	0.178	0.184
C.D. at 5%	0.32	0.45	0.63	0.44	0.51	0.30	0.20	0.25	0.39	0.39

Table 2: Change in pH, moisture content, overall acceptability of ber candy during storage

Treatments	pH					Moisture content					Overall acceptability				
	Initial	20 days	40 days	60 days	80 days	Initial	20 days	40 days	60 days	80 days	initial	20 days	40 days	60 days	80 days
T_1	5.02	4.95	4.81	4.69	4.41	19.84	17.77	15.72	13.72	11.56	6.98	6.94	6.89	6.84	6.76
T_2	5.16	5.07	4.89	4.71	4.56	18.87	16.94	15.66	13.56	11.57	7.05	6.99	6.95	6.89	6.82
T_3	5.21	5.16	5.09	4.99	4.72	20.00	17.86	15.21	13.71	11.99	6.88	6.83	6.79	6.73	6.67
T_4	4.55	4.46	4.31	4.21	4.02	19.90	17.93	16.14	13.82	11.94	7.13	7.09	7.04	6.97	6.92
T_5	5.12	5.03	4.91	4.78	4.49	19.06	17.91	15.87	13.85	11.66	6.96	6.90	6.85	6.79	6.74
T_6	4.25	4.19	4.04	4.00	3.89	19.95	17.84	15.64	13.84	11.99	6.61	6.58	6.54	6.50	6.45
T_7	4.17	4.11	4.08	4.01	3.97	19.63	17.69	15.89	13.85	11.76	8.49	8.44	8.39	8.33	8.28
T_8	4.57	4.51	4.44	4.33	4.24	18.67	17.11	15.81	13.95	11.93	7.25	7.23	7.18	7.11	7.06
T_9	4.89	4.81	4.71	4.55	4.39	20.09	18.46	16.06	14.32	12.09	7.92	7.87	7.80	7.73	7.67
F-test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**NS**	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed(±)	0.063	0.063	0.024	0.044	0.024	0.063	0.084	0.148	0.192	0.134	0.191	0.194	0.203	0.201	0.212
C.D. at 5%	0.05	0.04	0.08	0.05	0.07	0.17	0.21	0.34	0.36	0.25	0.38	0.40	0.41	0.42	0.46

Conclusion

In this present investigation that treatment T_7 (stepping in 40º B syrup + blanching in 0.2% KMS solution) + 1% citric acid) was found most suitable treatment in terms of physico-chemical properties, organoleptic test and cost benefit ratio of ber candy.

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