Indian J. Hort. 70(4), December 2013: 566-570

Effect of sugar concentration and time interval on quality and storability of *ber chuhara*

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ABSTRACT

Conditions were optimized to develop a candy like product (*chuhara*) from *ber* (*Zizyphus mauritiana*) by osmo-air drying process. The pretreatments like dipping in boiling NaOH (5%) solution for 5 min. followed by rinsing in water along with citric acid (5%) and finally dipping in KMS solution (4000 ppm) for 12 h accelerated the rate of osmosis. Pretreated *ber* fruits were then dipped in different sugar concentrations of 40, 50, 60 and 70°Brix at 24, 48 and 72 h. The treated fruits were then air-dried at 52 ± 2°C. With the increase in storage period, the moisture, ascorbic acid and tannin contents decreased, whereas, total sugars increased. On the basis of quanitative parameters and sensory traits it was found that *ber chuhara* prepared with 60°Brix steeping for 72 h rated the best, followed by those prepared with 70 or 50°Brix sugar syrups.

Key words: *Ber*, pre-treatments, candy, storage.

INTRODUCTION

Ber (*Zizyphus mauritiana*), popularly known as 'Apple of desert' excels many important fruits like apple and orange in vitamins and mineral contents. Its fruit is a rich source of vitamin C. The fruit ripens in March-April when practically no other fruits are readily available in the market. Total area under *ber* cultivation in Jammu is around 7,851.87 ha of land with the production of 13,074.0 MT (Anon, 2). As a result, seasonal glut has started in the local market and growers are not realizing remunerative price for their produce. Moreover, the shelf-life of *ber* fruit is very short as after harvesting, if not handled properly, it becomes over mature within two days at ambient temperature. Therefore, developing and standardization of processing techniques such as the preparation of squashes, jam, *murabba*, candy etc. will help to stabilize the price level and utilize the surplus produce.

Aggarwal *et al*. (1) had made *chuhara*-like product from *ber*, after cabinet drying colour of these products was golden brown to dark brown with moderate to high shriveling. Various workers have advocated the use of osmo-air drying of fruits as such products have better appearance, flavour, taste and texture (Unde *et al.*, 12). Thus, it becomes imperative to develop and standardize new techniques for preparing value-added products of *ber* fruit.

MATERIALS AND METHODS

Fully mature *ber* fruits of cv. Umran were purchased from Vijaypur Nursery of Department of Horticulture, Jammu. Fruits were transported to the Division of Post Harvest Technology, SKUAST of Jammu where they were thoroughly washed with water and subjected to different pre-treatments. Fruits were dipped in boiling lye solution NaOH (5%) for 5 min. and then washed thoroughly under tap water. Subsequently, the fruits were dipped in citric acid (5%) solution for 5 min. to neutralize residual alkali from their surface. After neutralizing, the fruits were again washed in running water. For post lye peeling, fruits were dipped in potassium metabisulphite (KMS) solution (4000 ppm) for 12 h. Different sugar syrup concentrations of 40, 50, 60 and 70°Brix were prepared and fruits were steeped for 24, 48 and 72 h.

The steeped fruits were drained and rinsed in water to remove adhering sugar syrup from the surface and were then spread on steel trays for drying in a dehydrator at 52 ± 2°C. Dried *chuharas* were taken out from the dehydrator at about 15% moisture level, allowed to cool and were then packed in plastic food grade jars and stored at room temperature for a period of six months for periodical physico-chemical analyses. Ascorbic acid content and sugars were measured by AOAC (3), while, tannin content was measured by Folin-Denis's colorimetric method and sensory evaluation was done using standard method (Ranganna, 8). The data were analyzed statistically through ANOVA using CRD factorial design (Gomez and Gomez, 4).

RESULTS AND DISCUSSION

Moisture content of *ber chuhara* decreased with the increase in storage period (Table 1). With the

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increase in steeping time intervals from 24 to 72 h of different sugar concentrations the mean values of per cent moisture decreased from 14.05 to 13.96 during 24 h, 14.00 to 13.92 during 48 h and from 13.94 to 13.87 during 72 h from 2 to 6 months of storage, respectively. With the increase in sugar concentration from 40 and 70^{0}Brix the moisture content also decreased from 15.83 to 12.55 and 15.75 to 12.48% from 2 to 6 months of storage, respectively. The decrease in moisture content might be due to natural dehydration of product during storage at room temperature. These findings are in conformity with the earlier findings of Kannan and Thirumaran (5). Similar results were also reported by Mehta *et al*. (6) in lemon peel waste candy and Pant *et al.* (7) in *aonla* candy.

The mean ascorbic acid content during 6 months of storage declined significantly from the initial level of 59.67 to 22.00 mg/100 g in *ber chuhara* steeped in 40^{0}Brix and from 57.33 to 17.77, 52.70 to 14.16 and 46.33 to 14.03 mg/100 g in *ber chuhara* steeped in 50, 60 and 70^{0}Brix, respectively (Table 2). On comparing the treatments, on the basis of mean values at 2, 4 and 6 month storage period, all the treatments differed significantly at 5% level of significance. Moreover, interaction effects of ^{0}Brix and time period were found to be non-significant. The decreasing trend in ascorbic acid during storage had also been reported by Tandon *et al*. (11) in *aonla* candy and Rashmi *et al.* (9) in osmo-dehydrated pineapple. It is well documented that ascorbic acid is hence most sensitive to heat; hence oxidized quickly in the presence of oxygen during processing and subsequently during storage.

The tannin content decreased significantly from the initial mean values of 1.56 to 1.38 (after 24 h), 1.47 to 1.38 (after 48 h) and from 1.46 to 1.35 mg/100 g (after 72 h of steeping) having different sugar concentrations ranging from 40 to 70°Brix (Table 3). Moreover, the ^{0}Brix concentration and time period interaction was statistically significant at 5% level of significance. The decrease in tannins during storage might be due to the formation of precipitates with organic constituents. Tannins are well known to have their influence on the flavour of the product as they are astringent in taste.

Per cent total sugars content of *ber chuhara* showed an increasing trend during 6 months of storage. It increased from the initial mean values of 71.43 to 73.91, 75.80 to 77.68, 77.73 to 79.75 and 79.14 to 81.51 developed from 40, 50, 60 and 70 ^{0}Brix upto 6 months of storage, respectively. On comparing the per cent total sugars content between the steeping periods after 6 months of storage, it increased from 78.03 to 78.36 with the increase

Table 1. Effect of different sugar syrup concentrations, time intervals and storage on per cent moisture of *ber chuhara*.

Treatment (°Brix)	Storage period														
	0 month				2 month				4 month				6 month			
	Steeping period (h)				Steeping period (h)				Steeping period (h)				Steeping period (h)			
	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean
40	15.92	15.86	15.80	15.86	15.90	15.82	15.76	15.83	15.80	15.77	15.72	15.76	15.78	15.76	15.70	15.75
50	14.78	14.74	14.69	14.74	14.73	14.70	14.65	14.69	14.70	14.78	14.63	14.70	14.68	14.65	14.62	14.65
60	12.98	12.95	12.90	12.94	12.96	12.92	12.86	12.91	12.90	12.86	12.81	12.86	12.80	12.80	12.74	12.79
70	12.64	12.58	12.52	12.58	12.61	12.55	12.48	12.55	12.58	12.50	12.45	12.51	12.55	12.46	12.42	12.48
Mean	14.08	14.03	13.98		14.05	14.00	13.94		13.99	13.98	13.90		13.96	13.92	13.87	
CD (P = 0.05)	0 month				2 month				4 month				6 month			
°Brix	0.01				0.01				0.01				0.01			
Time	0.01				0.01				0.01				0.01			
°Brix × time	NS				0.02				0.02				0.01			

Table 2. Effect of different sugar syrup concentrations, time intervals and storage on ascorbic acid content (mg/100 g) of *ber chuhara*.

Treatment (°Brix)	Storage period															
	0 month				2 month				4 month				6 month			
	Steeping period (h)				Steeping period (h)				Steeping period (h)				Steeping period (h)			
	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean
40	60.00	60.00	59.00	59.67	50.00	50.00	48.00	52.78	36.00	35.00	31.00	34.00	23.00	22.00	21.00	22.00
50	57.50	57.50	57.00	57.33	47.30	47.00	44.00	45.78	30.30	28.00	27.00	28.43	19.00	18.00	16.30	17.77
60	54.60	54.50	49.00	52.70	40.30	39.00	35.30	38.22	27.00	26.00	24.60	25.87	12.67	15.00	14.80	14.16
70	48.80	47.20	43.00	46.33	34.30	34.00	30.00	32.11	24.40	24.30	22.00	25.57	14.60	14.30	14.20	14.03
Mean	55.22	54.80	52.00		42.97	42.50	39.32		29.42	28.32	28.15		17.32	17.32	16.32	
CD (P = 0.05)	0 month				2 month				4 month				6 month			
°Brix	0.45				0.75				1.05				2.34			
Time	NS				0.91				0.91				NS			
°Brix × time	NS				NS				NS				NS			

Table 3. Effect of different sugar syrup concentrations, time intervals and storage on tannin content (mg/100 g) of *ber chuhara*.

Treatment (°Brix)	Storage period															
	0 month				2 month				4 month				6 month			
	Steeping period (h)				Steeping period (h)				Steeping period (h)				Steeping period (h)			
	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean
40	1.56	1.56	1.56	1.56	1.52	1.50	1.50	1.51	1.48	1.48	1.47	1.48	1.44	1.43	1.42	1.43
50	1.50	1.48	1.47	1.48	1.46	1.46	1.44	1.45	1.46	1.46	1.43	1.45	1.40	1.40	1.37	1.39
60	1.40	1.43	1.42	1.43	1.44	1.39	1.39	1.39	1.40	1.40	1.39	1.40	1.36	1.36	1.33	1.35
70	1.41	1.40	1.38	1.40	1.38	1.36	1.32	1.35	1.37	1.36	1.30	1.34	1.32	1.31	1.26	1.30
Mean	1.47	1.47	1.46		1.44	1.43	1.41		1.43	1.42	1.40		1.38	1.38	1.35	
CD (P = 0.05)	0 month				2 month				4 month				6 month			
°Brix	0.01				0.01				0.01				0.01			
Time	0.01				0.01				0.01				0.01			
°Brix × time	0.01				0.01				0.02				0.01			

in time of steeping from 24 to 72 h, respectively. Interaction effect between ^{0}Brix and time intervals at 0, 2, 4 and 6 months storage was found to be significant (Table 4).

These findings are in consonance with the findings of Rashmi *et al*. (9) and Relekar *et al*. (10). Other possible reason for gradual increase in total sugars with increased period of storage could be explained by the fact that the polysaccharides, which were present in the preserve might have converted into monosaccharide. The increase might also be attributed to hydrolysis of starch into sugars under high temperature and acidic conditions (Mehta *et al*., 6).

The mean overall acceptability score of *ber chuhara* decreased from 5.50 to 4.90 after 24 h, 5.70 to 5.00 after 48 h and from 5.80 to 5.10 after 72 h of steeping with 40^{0}Brix from 2 to 6 months of storage, respectively. Similarly, it also decreased from 7.40 to 6.80, 7.60 to 7.13 and 7.90 to 7.50 after 24, 48 and 72 h of steeping in *ber chuhara* having 60^{0}Brix syrup. The pooled storage means at different time intervals for overall acceptability score also decreased from the initial score of 7.30 to 6.22 after 6 months of storage. Similarly, the pooled treatment (^{0}Brix) mean score of overall acceptability for stored *ber chuhara* could be ranked as 60^0 > 70^0> 50^0 and 40^{0}Brix having values as 7.62 > 7.42 > 6.45 > 5.50, respectively. The interaction effect of treatment and time interval period (^{0}Brix and time) was found to differ significantly at 5% level of significance (Table 5).

Table 4. Effect of different sugar syrup concentrations, time intervals and storage on per cent total sugars of *ber chuhara*.

Treatment (°Brix)	Storage period															
	0 month				2 month				4 month				6 month			
	Steeping period (h)				Steeping period (h)				Steeping period (h)				Steeping period (h)			
	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	24 hour	48 hour	72 hour	Mean
40	71.39	71.43	71.46	71.43	71.42	71.45	71.49	71.45	72.54	72.74	72.80	72.69	73.82	73.94	73.98	73.91
50	75.54	75.62	76.24	75.80	75.60	75.64	76.27	75.84	76.65	76.87	76.99	76.84	76.52	77.68	77.84	77.68
60	77.62	77.64	77.92	77.73	77.69	77.69	77.74	77.80	78.23	78.56	78.92	78.57	79.56	79.82	79.88	79.75
70	79.02	79.09	79.30	79.14	79.52	79.67	79.69	79.63	80.12	80.46	80.74	80.44	81.24	81.56	81.74	81.51
Mean	75.89	75.94	76.23		76.06	76.12	76.36		76.88	77.16	77.36		78.03	78.25	78.36	
CD (P = 0.05)	0 month				2 month				4 month				6 month			
°Brix	0.01				0.04				0.01				0.01			
Time	0.01				0.03				0.01				0.01			
°Brix × time	0.02				0.07				0.02				0.02			

REFERENCES

1. Aggarwal, P., Kour, B. and Bal, J.S. 1997. Studies on dehydration of different ber cultivars for making ber *chuharas*. *J. Fd. Sci. Tech.* **34**: 534-36.
2. Anonymous, 2012. Annual area and production of ber fruit in J&K. Directorate of Economic and Statistics, J&K Govt. pp. 75-76.
3. A.O.A.C. 1990. *Official Method of Analysis* (14th Edn.), Association of Official Analytical Chemists, Washington, D.C.
4. Gomez, K.A. and Gomez, A.A.1984. *Statistical Procedures for Agricultural Research* (2nd Edn,), A Wiley-Interscience Publication, John Wiley and Sons, New York.
5. Kannan, S. and Thisumaran, S. 2002. Studies on the syruping and drying methods of ber (*Zizyphus mauritiana* Lamk.) candy. *Bev. Fd. World*, **29**: 39-40.
6. Mehta, A., Ranote, P.S. and Bawa, A.S. 2005. Processing of *kandi* lemon (*Galgal*) peel waste

Table 5. Effect of different sugar syrup concentrations, time intervals and storage period on the sensory score of overall acceptability of *ber chuhara*.

Treatment	Storage period																Treatment mean
	0 month				2 month				4 month				6 month				
	Steeping period (h)				Steeping period (h)				Steeping period (h)				Steeping period (h)				
	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	24	48	72	Mean	
40 °Brix	6.00	6.10	6.20	6.10	5.50	5.70	5.80	5.67	5.20	5.30	5.30	5.27	4.90	5.00	5.10	5.00	5.50
50 °Brix	6.80	6.90	7.20	6.97	6.40	6.50	6.80	6.57	6.00	6.50	6.50	6.33	5.60	5.90	6.30	5.93	6.45
60 °Brix	7.70	8.00	8.10	7.93	7.40	7.60	7.90	7.63	7.10	7.40	7.70	7.40	6.80	7.13	7.50	7.14	7.62
70 °Brix	8.07	8.20	8.30	8.19	7.70	7.70	7.40	7.60	7.00	7.10	7.30	7.13	6.67	6.80	6.90	6.79	7.42
Mean	7.14	7.30	7.45		6.75	6.87	6.97		6.32	6.57	6.70		5.99	6.21	6.45		
Storage/Time interval mean		7.30				6.87				6.53				6.22			
CD (P = 0.05)		0 month				2 month				4 month				6 month			
°Brix		0.11				0.11				0.07				0.07			
Time		0.10				0.10				0.06				0.06			
°Brix × time		NS				0.19				0.13				0.12			

for candy making. *Indian Fd. Packer*, **59**: 67-74.

7. Pant, K., Dhaman, S.S., Goyal, R.K. and Dhawan, K. 2004. Effect of pre-drying treatment on nutritional quality of aonla (*Emblica officinalis* Gaertn.). *Indian Fd. Packer*, **59**: 67-74.

8. Ranganna, S. 1986. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (2nd Edn.), Tata McGraw Hill Pub. Co. Ltd., New Delhi.

9. Rashmi, H.B., Gowda, D.I.M. and Mukenda, G.K. 2005. Studies on osmo-air dehydration of pine apple fruits. *J. Fd. Sci. Tech.* **42**: 64-67.

10. Relekar, P.P., Naik, A.G. and Padhiar, B.V. 2011. Qualitative changes in value-added products of sapota cv. Kalipatti during storage. *Indian J. Hort.* **68**: 413-18.

11. Tandon, D.K., Yadav, R.C., Sood, S., Kumar, S. and Dikshit, A. 2003. Effect of blanching and lye peeling on the quality of aonla candy. *Indian Fd. Packer*, **57**: 147-52.

12. Unde, P.A., Kanawade, V.L.S. and Jadhav, S.B. 1998. Effect of syruping and drying methods on quality of ber candy. *Indian Fd. Sci Tech.* **35**: 259-61.

Received : May, 2011; Revised : January, 2013; Accepted : April, 2013