Journal of Applied and Natural Science 8 (2): 630 - 633 (2016)

JANS

Evaluation of cultivars and packing materials during preparation and storage of ber candy

Balveer Singh[1*] and Sanjay Pathak[2]

[1]Department of Post Harvest Technology of Horticultural Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalay, Mohanpur, Nadia-741252 (W.B.), INDIA
[2]Department of Post Harvest Technology, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad-224229 (U.P.), INDIA
*Corresponding author. E-mail: balveer048@gmail.com

Received: March 17, 2015; Revised received: February 8, 2016; Accepted: April 17, 2016

Abstract: Ber (*Zizyphus mauritiana*) is known as poor man's fruit and is rich in protein, phosphorus, calcium, carotene and vitamin-C. The present investigation was conducted at laboratory Department of Post Harvest Technology collage of Horticulture and forestry, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during the year 2010-11. The physico-chemical characteristics were evaluated for different caltivars viz., Illaichi, Ponda, Umran, Gola, Banarsi Karaka and Narendra Ber Sel-2. The cultivars physico-chemical composition of ber fruit and organoleptic quality of candies Banarsi Karaka was found best suited among all cultivars for making of candy. Storage studies indicated that LDPE film was better in comparison to glass jar and plastic jar for packaging of ber candy at ambient temperature and candy was found in good condition after 9 months of storage period in LDPE film. The maximum cost benefit ratio of ber candy was found to be 1: 1.25 than packed in LDPE film followed by plastic jar and glass jar.

Keywords: Ber candy, Fruits, organoleptic quality, Sugar

INTRODUCTION

The jujube or ber (*Ziziphus spp*.), which is mainly distributed in the subtropical and tropical regions of Asia and America, is a tree of Rhamnaceae family. This fruit probably originated in India. The Jujube fruits in the Mediterranean region have various shapes, sizes, colors and tastes and have been reported to possess unique nutritional and organoleptic characteristics (Akbolat *et al*., 2008). Ber pulp contains 12-23% T.S.S., 0.13-1.42% acidity, 3.1-14.5% total sugars, 1.4 -9.7% reducing sugars (Ghosh and Mathew 2002). The food from this plant is an important source of energy, protein and minerals (Li *et al*., 2007). The candy product are getting more popularity among other dehydrated products because these product are tasty, easy to handling and have better self life and transportation quality. Packaging containers play a vital role for retaining and maintain quality for longer time. Therefore, evaluations of packaging containers are important for candy industry.

MATERIALS AND METHODS

The mature ber fruits of each cultivar were taken in the study, for making of candy. Fruits washed from the fresh water. The washed ber fruits were pricked at all four sides by hand operated pricking knife. The pricked ber fruits were dipped in 2% lime solution in six separate utensils for 24 hours. There after the fruits were washed thoroughly with water and blanched in boiling water for five minutes. The blanched fruits were steeped in to 50 (per cent), and 60 (per cent) T.S.S. syrup for 24 hours there after the fruits were dipped in 70 (per cent), T.S.S. syrup for 7 days. Then fruits were drained and wash out its upper layer syrup with dipped into hot water 2-3 times for few seconds after putting into muslin cloth. These candies were dried into hot air oven at 50ºC for 12 hours. The screening of ber cultivars for candy was evaluated by organoleptic evaluation. The preparation of candy from different ber cultivars and packed in Low Density Polyethylene packet, glass jar and plastic jar were analysed for chemical parameter initially and at interval of one month upto nine month of storage period. Completely randomized block design was adopted for statistical analysis. The candy in different packaging containers was adopted for recording the observations total soluble solids were estimated using a hand refractometer. The titratable acidity was determined by titrating against standard N/10 NaOH using phenolphthalein as an internal indicator. The ascorbic acid (mg/100g) content of candy were determined by using 2, 6 dichlorophenol-indophenol dye by visual titration method. Reducing sugars, non-reducing sugar and total sugars contents of the candy were estimated following the standard method described (AOAC, 1970). Total

phenol was determined by following the procedure with 80% boiling ethanol and estimating using folinaenous reagent calorimetrically. The non-enzymatic browning in products was assessed by the methods as described Rangnana (1986). The organoleptic evaluation of ber candy in different packaging containers were carried out by panel of 10 judges using 9 point hedonic scale. The cost: benefit ratio of ber candy was calculated (Singh, 1988).

RESULTS AND DISCUSSION

Changes in total soluble solids, acidity, ascorbic acid and total phenols of ber candy are presented in Table - 1. The total soluble solids in per cent were gradually increased significant up to 7 month of storage after that, increased gradually till the storage period. The retention of total soluble solids was found more in plastic jar followed by glass jar and LDP packet. The total soluble solids increased during storage under each packaging containers of ber candy. It is conservation of polysaccharides and oligosaccharides into monosaccharides. The titratable acidity of ber candy was increased during storage. The acidity per cent showed non-significant in LDP packet whereas, significant in plastic jar and glass jar during the storage of ber candy. The Pectic substances have been reported to increase

Table 1. Changes in total soluble solids, acidity, ascorbic acid and total phenols during storage in ber candy.

Storage period (in month)	Total soluble solids (%)			Acidity (%)			Ascorbic acid (mg/100g)			Total phenols (mg/ 100g)		
	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar
0	70.00	70.00	70.00	0.12	0.12	0.12	16.00	16.00	16.00	26.40	26.40	26.40
1	70.03	70.07	70.10	0.12	0.15	0.14	15.67	15.53	15.58	26.32	26.08	26.08
2	70.17	70.13	70.27	0.15	0.15	0.17	15.20	15.30	15.34	25.40	25.60	25.63
3	70.53	70.80	70.80	0.16	0.19	0.19	14.83	14.74	15.02	25.43	25.27	25.17
4	71.17	71.63	71.73	0.17	0.21	0.21	14.43	14.43	14.68	25.03	24.83	24.57
5	71.97	72.83	72.57	0.19	0.25	0.23	13.87	13.87	14.27	24.88	24.43	24.03
6	72.70	73.48	73.42	0.21	0.25	0.24	13.54	12.90	14.09	24.50	23.97	23.47
7	73.40	73.97	74.10	0.24	0.27	0.26	12.97	12.44	13.57	24.10	23.37	23.07
8	74.10	74.70	74.93	0.26	0.28	0.26	12.57	12.03	13.12	23.40	22.90	22.70
9	74.80	75.53	75.70	0.27	0.29	0.28	12.33	11.53	12.67	23.23	22.67	22.43
CD at 5%	3.45	3.50	3.46	NS	0.06	0.07	NS	0.458	0.302	0.252	0.254	0.381

Table 2. Changes in Reducing sugars, non-reducing sugar and total sugars (per cent) during storage in ber candy.

Storage period (in month)	Reducing sugars (%)			Non-reducing sugar (%)			Total sugars (%)		
	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar
0	28.10	28.10	28.10	40.00	40.00	40.00	68.10	68.10	68.10
1	28.33	28.32	28.39	40.41	40.20	40.30	68.69	68.53	68.69
2	28.68	28.82	28.71	40.71	40.62	40.84	69.54	69.30	69.56
3	28.95	29.15	29.10	40.93	40.80	41.16	69.93	69.93	70.33
4	29.19	29.36	29.38	41.25	41.42	41.70	70.42	70.60	71.08
5	29.48	29.73	29.69	41.73	41.80	41.42	71.25	71.48	71.65
6	29.81	29.19	30.16	42.11	42.53	42.45	71.95	72.55	72.52
7	30.14	30.45	30.41	42.37	42.74	42.67	72.51	72.85	73.07
8	30.46	30.81	30.80	42.69	42.98	42.94	73.05	73.37	73.74
9	30.76	30.93	30.81	42.99	43.23	43.10	73.63	73.86	74.40
CD at 5%	2.18	2.25	2.20	3.41	3.56	3.47	4.52	4.58	4.55

Table 3. Changes in browning, organoleptic quality and physiological losses in weight during storage of ber candy.

Storage period (in month)	Browning (OD)			Organoleptic quality (9 point hedonic scale)			Physiological losses in weight (g)		
	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar	LDP packet	Glass jar	Plastic jar
0	0.30	0.30	0.30	9.00	9.00	9.00	500.00	500.00	500.00
1	0.35	0.35	0.36	9.00	8.80	9.00	499.00	493.33	498.83
2	0.41	0.41	0.41	9.00	8.55	8.75	497.83	490.33	495.13
3	0.46	0.47	0.48	8.75	8.30	8.50	496.17	488.00	494.50
4	0.51	0.52	0.54	8.60	8.00	8.25	495.50	486.83	492.83
5	0.55	0.58	0.59	8.50	7.75	8.00	495.00	485.50	492.17
6	0.60	0.64	0.63	8.25	7.60	7.75	494.67	483.67	490.67
7	0.64	0.70	0.68	8.00	7.45	7.60	493.33	482.50	490.00
8	0.68	0.76	0.70	7.85	7.25	7.45	492.50	481.83	487.67
9	0.70	0.78	0.74	7.70	7.00	7.30	491.00	480.83	486.67
CD at 5%	0.033	0.029	0.034				NS	1.566	1.494

Table 4. Cost: benefit ratio of ber candy.

S. N.	Particulars	Rate (Rs.)	Cost (Rs.)
1	Ber fruit	(100 kg) Rs 15/kg	1500.00
2	Sugar	(125 kg) Rs 31/kg	3875.00
3	Lime	(2.00 kg) Rs 15/kg	30.00
4	Citric Acid	(200 g) Rs 80/kg	16.00
5	Labour charge	120 Rs/day/labour	840.00
6	LPG (liquid petroleum gas) charge	345 Rs/cylinder	230.00
7	Packaging containers (one kg capacity)	58 bag @ Rs 170/kg(400 bag) LDP packet	24.65
		58 bag @ Rs 10/kg/glass jar	580.00
		58 bag @ Rs 8/kg/plastic jar	464.00
8	Total cost of production	LDP packet	6515.65
	(1+2+3+4+5+6+7)	Glass jar	7071.00
		Plastic Jar	6955.00
9	Gross return of 58 kg candy	LDP packet @ Rs 140/kg	8120.00
		Glass jar @ Rs 145/kg	8410.00
		Plastic Jar @ Rs 145/kg	8410.00
10	Net return	LDP polyethylene packet	1604.35
		Glass jar	1339.00
		Plastic Jar	1455.00
11	Cost : benefit ratio	LDP polyethylene packet	1: 1.25
		Glass jar	1: 1.19
		Plastic Jar	1: 1.21

the acidity in fruit product and slight increase in the acidity of ber candy was observed during storage at ambient temperature (Mishra, 2005).

Ascorbic acid content in ber candy packed in LDP packet showed (16.00-12.33 mg/100g) whereas, candy packed in plastic jar showed (16.00-12.67 mg/100g) and glass jar (16.00-11.53 mg/100g) entire period of storage respectively. The retention of ascorbic acid was more when stored under LDP packet (12.33 mg/100g) followed by plastic jar (12.67 mg/100g) and then glass jar (11.53 mg/100g) during ambient storage. The reduction of ascorbic acid content could be due to oxidation of ascorbic acid into dehydro ascorbic acid by oxygen in containers during storage have been reported by Gupta (2007) in osmo-dehydrated ber. Total phenols was found significant in LDP packet packed while in glass jar and plastic jar showed non-significant difference during eight and two months of storage respectively.

The reducing sugars, non-reducing sugar and total sugars content of ber candy increased continuously during the entire period of storage in all packaging containers showed in Table 2. The retention of reducing sugars in LDP packet showed significant difference during 7 month of storage whereas; glass jar and plastic jar showed significant difference during 6 month of storage in both containers. The reducing sugar was increase due to the inversion of non-reducing to reducing sugars and hydrolysis of polysaccharides into monosaccharides. Candy packed in LDP packet showed significant difference up to 7 month of storage whereas, glass jar and plastic jar showed significant difference up to 6 month of storage in both containers. Inversion of the non-reducing sugars show rapid into plastic jar followed by glass jar and LDP packet show retention of inversion process observed (Mishra, 2005). Total sugars in LDP packet showed significant till 7 month of storage whereas, glass jar and plastic jar showed significant difference increased during the 6 month of storage in both containers. The reducing sugars, non-reducing sugar and total sugars (per cent) found better under LDP packet packed container than the candy packed under plastic jar and glass jar.

During storage, changes in browning, organoleptic quality and physiological losses in weight is showed in Table-3. Candy packed in LDP packet, glass jar and plastic jar showed significant difference in browning up to seven month, five month and eight month of storage. The browning in plastic jar packed candy was found more than other containers whereas, minimum browning was found in glass jar. In the present investigation non-enzymatic browning of ber candy were mainly increased due to non-enzymatic reaction between nitrogenous compounds with sugars or organic acids and among organic acid with sugar entire period of storage by Helmy *et al*. (2012). The organoleptic score of ber candy decreased during the storage. The acceptability of product was maintained up to 9 months in LDP packet whereas, 5 months and 4 months in plastic jar and glass jar respectively at ambient temperature. Similarly, reduction in organoleptic scores of ber candy (Kumar *et al*., 1992), osmo dehydrated pineapple (Rashmi *et al.,* 2005) and apricot (Sharma *et al.,* 2006). The physiological loss of weight in ber candy packed in LDP packet showed (500-491g) plastic jar (500-486.67g) and glass jar (500-480.83g) during entire period of storage respectively. Lowest physiological loss of weight was found in LDP packet (491.00g) than plastic jar (486.67g) and glass jar (480.83g) respectively.

The maximum cost benefit ratio of ber candy was found 1:1.25 packed in LDP packet followed by 1:1.21

in plastic jar and minimum cost benefit ratio was found in glass jar. On the basis of chemical changes during storage and cost: benefit ratio LDP packet was found best followed by plastic jar and glass jar for longer time retention of ber candy (Table 4).

Conclusion

It was concluded that the maximum organoleptic quality and cost: benefit ratio of ber candy was in LDP packet followed by plastic jar and glass jar. LDP packet was better in comparison to glass jar and plastic jar for packaging of candy at ambient temperature and candy was found in good condition even after 9 months of storage period in LDP packet.

ACKNOWLEDGEMENT

The authors are grateful to Dr. H.K. Singh, Head, Department of Horticulture, Narendra Deva University of Agriculture &Technology, Kumarganj, Faizabad for providing necessary facility and guidance to complete this study.

REFERENCES

Akbolat, D., Ertekin, C., Menges, H.O., Ekinci, and Erdal, K. (2008). Physical and nutritional properties of jujube (*Zizyphus jujube* Mill.) growing in turkey. *Asian J. Chem*., 20: 757-766.

AOAC (1970). Official methods of analysis association of official agricultural chemical. *Washington, D.C., 11th edition*.

Ghosh, S.N. and Mathew, B. (2002). Performance of nine ber (*Zizphus mauritiiana* Lamk) cultivars on topworking in the semi-aried region of west Bengal. *J. Appl. Hort*., 4(1): 49-51.

Gupta, N. (2007). 'Studies on processing and preservation of ber' Ph D thesis, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jummu, India.

Helmy, I.M.F., Wafaa, M.A., and Nadir, A. (2012). Nutritional evaluation of some products from ber fruits. *Nature and Science,* 10(8).

Kumar, S., Ojha, M., Deen, B., Awasthi, O.P. and Nainwal, N.C. (1992). Potentiality of ber (*Zizyphus mauritiana* Lamk) cultivars for candy making. *Prog. Hort*., 24 (1/2): 74-78.

Li, J.W., Fan, L.P., Ding, S.D. and Ding, X.L. (2007). Nutritional composition of five cultivars of Chinese jujube. *Food Chemistry*, 103: 454-460.

Mishra, D.K. (2005). Studies on bael *(Aegle marmelos Correa.)* candy. *MSc. (Ag)*. Thesis, NDUA&T, Faizabad.

Rangnana, S. (1986). Handbook of Analysis and Quality control for Fruit and Vegetable Products. *Tata Mc Graw - Hill Publish. Co. Ltd*., p. 1103.

Rashmi, H.B., Gowda, D.I.M. and Mukenda, G.K. (2005). Studies on osmo air dehydration of pineapple fruits. *J. of food Sci. and Tech.*. 42(1): 64-7.

Sharma, H.R., Handa, P and Verma, R. (2006). Organoleptic and chemical evaluation of osmotically processed apricot whomles and halves. *Natural Products Radiances* 5(5): 350-6.

Singh, I.S. (1988). Changes during storage of aonla intermediate moisture food. Paper presented at national workshop on post harvest technology of horticulture crops. *Help at Dapoli.*