

Effect of Different Treatments and Drying Methods on Quality of Dehydrated Ber

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Abstract

Ber (*Zizyphus mauritiana* Lamk.) has a limited post-harvest life. Loss of moisture, shrivelling and physiological disorder are some major post-harvest constraints in ber. Under ordinary conditions the shelf life of the fruit does not exceed 5 to 6 days. The present study was made on the effect of different sulfur treatments and drying methods on physico-chemical parameters and quality of dehydrated ber. Fruits were blanched in boiling water for six minutes, dipped in 1% potassium metabisulfite solution for five minutes, sulfur fumigation at 3.5 g/kg of fruit separately and in their combinations. After various pretreatments the fruits were dried under two conditions i.e. sun and oven. In oven dried samples, total soluble solids, rehydration ratio, acidity, ascorbic acid, reducing sugar, total sugar, browning, tannin, ash and minerals were higher as compared to sun dried ber. On assessing the sensory score it was found that oven dried fruits were more acceptable than sun dried fruits.

Key words : Ber, Dehydration, Sun drying, Oven drying, Quality.

Ber (*Zizyphus mauritiana* Lamk.) belongs to family Rhamnaceae. It is an ideal fruit of arid and subtropics regions of India. Umran is one of the high yielding commercial cultivar of ber ripening in mid-March to mid-April under Jammu conditions. Total area under ber cultivation in Jammu is around 4,552 ha of land with the production of 6,078 MT (1). However, due to short shelf life, it cannot be stored for longer period at ambient condition and cannot be transported to distant places. Thus during peak season there is a glut of this fruit in the local market and the growers get little prices of their crop due to its distress sale. The increase in shelf life would therefore be of advantage to the growers to obtain its remunerative prices. Ber is eaten mostly fresh but it can be processed into delicious products and dried forms. Dehydration is a method of removal of moisture under carefully controlled condition of airflow, temperature and relative humidity. Dehydrated products have longer shelf life and can be used in the off season. The information about dehydration of ber is limited. Different treatments have been tried to increase the shelf life of ber fruits at room temperature. The present study was undertaken to investigate the

effect of different treatments and drying methods on quality of dehydrated ber.

Methods

Umran variety of ber which is a commercially important was obtained at eating ripe stage from the Vijaypur nursery, of the Department of Horticulture Jammu located about 60 km North East of Jammu. Fruits were transported to the pilot plant of the Division of Post-Harvest Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu for further processing.

The washed fruit was subjected to different treatments like blanching in boiling water for six minutes, KMS dipping for five minutes, sulfur fumigation at 3.5 g/kg of fruit and in their combinations then dried separately in sun and oven (55±2 C) (Fig. 1). The details of the treatment are as follows. Treatment 1. No blanching + no preservative + sun drying, 2. No blanching + sulfuring + sun drying, 3. No blanching + KMS + sun drying, 4. Blanching + no preservative + sun drying, 5. Blanching + sulfuring + sun drying, 6. Blanching + KMS + sun drying, 7. No blanching +

Table 1. Physico-chemical characteristics of fresh ber fruit.

Physical Characteristics	
1. Color	Golden yellow
2. Fruit weight (g)	13.4
3. Fruit length (cm)	3.61
4. Fruit width (cm)	2.54
5. Specific gravity	0.98
6. Pulp-stone ratio (g)	14.5
Chemical Characteristics	
7. Total soluble solids (^o Brix)	18.8
8. Moisture (%)	84.4
9. Rehydration ratio	1.98
10. Acidity (%) (as anhydrous citric acid)	0.23
11. pH	5.2
12. Reducing sugar (%)	4.3
13. Total sugar (%)	8.8
14. Ascorbic acid (mg/100g)	108.4
15. Browning (OD at 440 nm)	0.75
16. Tannin (mg/100 g) (as tannic acid)	1.0 0.53
17. Ash	
18. Minerals	
Phosphorus (mg/100 g)	0.04
Calcium (mg/100 g)	23
Iron (ppm)	1.07

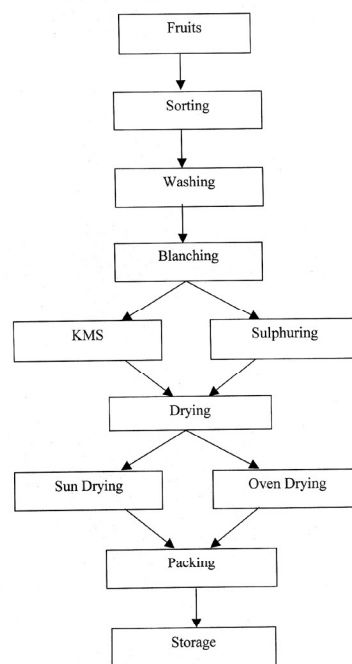
no preservative + oven drying, 8. No blanching + sulfuring + oven drying, 9. No blanching + KMS + oven drying, 10. Blanching + no preservative + oven drying, 11. Blanching + sulfuring + oven drying, and 12. Blanching + KMS + oven drying.

Physico-Chemical Analysis. Fresh and dehydrated ber fruit was subjected to various physico-chemical and sensory analyses using standard methods (2).

Sensory evaluation were carried out on the basis of color, texture, flavor/aroma and overall acceptability by semi trained taste panel of 7–8 judges by using 9 point hedonic scale assigning score 9—like extremely to 1—dislike extremely. A score of 5.5 and above was considered acceptable (3). The data were analyzed statistically by using three factor CRD factorial design (4).

Results and Discussion

The data pertaining to physico-chemical characteristics of ber fruit revealed that the color of the fruit

**Figure 1.** Flow chart for dehydration of ber.

varied from greenish yellow to golden yellow (Table 1), which was in conformity with the findings of Kumar and Nath (5). Average fruit weight of fresh ber was 13.4 g having length and breadth as 3.61 and 2.54 cm respectively and pulp stone ratio of 14.5 g which was in accordance with the findings of Kumar and Nath (5), Aggarwal et al. (6) and Jain and Khurdiya (7).

The moisture content of 84.4% was close to the value of 88.7% as reported by Sharma and Bawa (8) but higher than values of (76.42–77.81) as reported by Khurdiya (9) and Sood et al. (10) respectively. The rehydration ratio of fresh ber was found to be 1.98 and this was in conformity with the findings of Devraju et al. (11) and Srivastava and Kumar (12). The total soluble solids of 18.8^o Brix of the fresh ber was lower than the reported value of 22.7^oBrix by Khurdiya (9). Total sugar contents of 8.8% was found to be lower than reported by Khurdiya (9) for the same variety as 14.84% whereas reducing sugar was found to be 4.3% which was in conformity with the findings of Aggarwal et al. (6) and Kumar and Nath (5). The acidity of the fresh ber fruit was found to be as 0.23% whereas

Table 2. Effect of different pre-treatments and drying methods of dehydrated ber.

Treatments	Pre-treatments	Rehy-		Acidity (%)	Reducing sugars	Total sugars (%)	Browning (OD 440 nm)		Sulfur dioxide (ppm)	Ash (%)	Phosphorus (mg/100g)	Calcium (mg/100g)	Iron (ppm)	
		Moisture (%)	dration ratio				Ascorbic acid (mg/100g)	at Tannin (mg/100g)						
Sun Drying														
No blanching	No preservative	14.00	3.20	1.20	23.28	63.36	28.43	3.53	1.35	—	3.73	0.003	101.67	4.46
No blanching	Sulfuring	14.04	3.62	1.18	22.97	62.04	36.68	3.03	1.46	524	3.23	0.007	109.70	4.45
No blanching	KMS	14.03	3.37	1.17	22.82	61.78	37.67	2.85	1.38	520	3.03	0.006	107.90	4.43
Blanching	No preservative	14.03	3.26	1.12	22.72	60.24	39.72	2.48	1.34	—	2.72	0.004	105.33	4.32
Blanching	Sulfuring	14.00	3.50	1.14	22.80	60.73	36.56	2.72	1.39	518	3.00	0.005	107.57	4.40
Blanching	KMS	14.01	3.32	1.14	22.75	60.74	38.94	2.70	1.38	517	2.98	0.004	106.42	4.39
Oven Drying														
No blanching	No preservative	14.01	3.47	1.22	23.84	64.88	32.53	3.23	1.54	—	3.78	0.006	101.70	4.50
No blanching	Sulfuring	14.05	3.79	1.20	23.58	63.64	43.50	2.77	1.54	535	3.26	0.008	110.80	4.50
No blanching	KMS	14.05	3.59	1.18	23.54	62.39	44.43	2.74	1.47	532	3.20	0.007	109.85	4.48
Blanching	No preservative	14.04	3.51	1.13	23.38	61.24	47.52	2.47	1.38	—	2.80	0.005	106.24	4.35
Blanching	Sulfuring	14.01	3.68	1.16	23.42	61.46	42.64	2.64	1.42	530	3.04	0.006	108.46	4.46
Blanching	KMS	14.02	3.56	1.15	23.40	61.45	46.26	2.64	1.41	529	3.02	0.005	107.52	4.45
Interaction Effect														
Blanching × Drying		NS	NS	NS	0.02	0.02	NS	0.03	0.01	NS	0.02	NS	0.02	0.01
Blanching × Preservative		NS	0.01	NS	0.02	0.02	1.55	0.04	0.01	NS	0.02	NS	0.02	0.02
Drying × Preservative														
Blanching × Drying × Preservative		NS	0.01	NS	0.02	0.02	1.55	0.01	NS	NS	0.02	NS	0.02	NS
		NS	NS	NS	0.03	0.03	NS	0.05	NS	NS	0.03	NS	0.03	0.02

Khurdiya (9) reported higher acidity in var Illachi than in var Mudia, Murhara and Umran. Variation in acidity levels in different varieties might be due to different locations where these are grown and similar variation have been observed by Marimuthu and Thirumaran (13) and Kumar and Nath (5).

Ber had the ascorbic acid content of 108.4 mg/100g and this was in conformity with the earlier findings (8, 9, 13—17). Ber fruit recorded browning of 0.75 OD at 440 nm and similar results had been reported by Kumar (18). Percentage of ash content was found to be 0.53 which was in accordance with the values reported earlier (5, 8, 13). While the tannin content as mg tannic acid was found to be 1.0 mg/100g and similar findings have been registered by Kannan and Thirumaran (19) and Kumar and Nath (5). The fresh ber fruit contains mineral content of 0.04 mg/100g phosphorus, 23mg/100g calcium and 1.07 ppm iron which were in accordance with the values re-

ported by Smadiya and Verma (20) in Umran cv of ber.

The ber fruit was dried at 55 ± 2 C and the moisture content was maintained at about 14.00% (Table 2). The highest rehydration ratio of 3.79 was found in no blanching+ sulfuring in oven dried fruit while as the lowest rehydration ratio of 3.20 was found in no blanching+ no preservative in sun dried fruits. The highest percent acidity of 1.22 was found in no blanching+ no preservative in oven drying closely followed by no blanching+sulfuring in oven drying and by no blanching+ no preservative in sun drying method having value of 1.20% in both while as the lowest acidity content of 1.12% was recorded in blanching + no preservative in sun drying method. Tripathi et al. (21) reported the same value of 8.24% in dehydrated aonla. The data on the percent reducing sugar revealed that the highest reducing sugar content of 23.84 was observed in no blanching+no preservative in oven drying whereas the lowest reducing sugar of

Table 3. Effect of different pre-treatments and drying methods on sensory score evaluation of dehydrated ber.

Treatments	Pre-treatments	Color	Texture	Flavor	Overall acceptability
Sun Drying					
No blanching	No preservative	7.20	7.30	7.60	7.38
No blanching	Sulfuring	8.60	8.60	8.40	8.50
No blanching	KMS	8.30	8.47	8.20	8.30
Blanching	No preservative	7.80	8.00	7.80	7.87
Blanching	Sulfuring	8.20	8.30	8.10	8.20
Blanching	KMS	8.10	8.20	7.90	8.07
Oven Drying					
No blanching	No preservative	7.50	7.80	7.80	7.70
No blanching	Sulfuring	8.70	8.80	8.60	8.70
No blanching	KMS	8.50	8.70	8.40	8.50
Blanching	No preservative	8.00	8.30	8.00	8.10
Blanching	Sulfuring	8.40	8.60	8.30	8.40
Blanching	KMS	8.30	8.50	8.20	8.30
Interaction Effect					
Blanching × Drying		NS	NS	NS	NS
Blanching × Preservative		0.15	0.23	0.16	0.02
Drying × Preservative		NS	NS	NS	0.02
Blanching × Drying × Preservative		NS	NS	0.23	0.23

22.72% was found in blanching+no preservative in sun drying method. Cheema et al. (22), Salem and Nour (23), Gebhardt et al. (24) and Mali (25) reported the reducing sugar content of 45.95, 65.50, 51.3 and 46.01% in dried Poona fig. The highest and lowest values of total sugar were obtained by no blanching+ no preservative in oven drying and blanching+no preservative in sun drying having values as 64.88 and 60.24% respectively. Salem and Nour (23), Gebhardt et al. (24), Pawar et al. (26) and Mali (25) reported the values of total sugar content as 73.32, 52.90, 49.10 and 47.0% in dried Poona fig respectively were reported earlier (22—26). Significant results were observed in blanching, preservative and drying methods.

The highest ascorbic acid content of 47.52 mg/100g was recorded in blanching+ no preservative in oven drying method whereas the lowest ascorbic acid content of 32.53 and 28.43 mg/100g were found in no blanching+ no preservative of oven and sun dried treatments respectively. Khurdiya (9) and Tripathi et al. (21) reported the values of ascorbic acid as 142.9 and 178.65 mg/100g in dehydrated ber and in dehy-

drated aonla respectively. Maximum browning of 3.53 at (OD at 440 nm) was found in no blanching + no preservative in sun drying and no blanching+ no preservative in sun drying (3.23) while minimum browning of 2.48 was found in blanching+ no preservative in sun drying method. Khurdiya (9) reported the value of browning as 7.7 (OD at 440 nm) in dehydrated ber. The highest tannin content of 1.54 mg/100g was found in no blanching+ sulfuring in oven drying method while as the lowest tannin content of 1.34 mg/100g was found in blanching+ no preservative in sun drying method. Tripathi et al. (21) reported the value of tannin content as 2.23 mg/100g in dehydrated aonla. Significant results have been found between the interaction of blanching, preservative and drying methods.

In sun drying the lowest sulfur dioxide content of 517 ppm was observed in blanching+ KMS followed by blanching+sulfuring (518 ppm), no blanching+ KMS (520 ppm) and no blanching+ sulfuring (524 ppm) while in oven drying method the highest and lowest sulfur dioxide content of 535 and 529 ppm have been recorded in no blanching + sulfuring and

blanching+ KMS respectively. These results are in conformity by Khurdiya (9) who reported the value of sulfur dioxide as 530 ppm in dehydrated ber.

In sun drying method the lowest ash content of 2.72% was observed in blanching+no preservative followed by blanching + KMS (2.98), blanching+sulfuring (3.00) and no blanching+ KMS (3.03) while as in oven drying method the highest and lowest ash content of 3.78 and 2.80% had been recorded in no blanching+no preservative and blanching+no preservative respectively. Norman and Desrosier (27), Pawar et al. (26) and Mali (25) reported the values of ash content as 2.4, 2.9 and 2.0% in dried figs, respectively.

The phosphorus content of dehydrated ber varied from 0.003 to 0.008 mg/100g in sun drying method while it varied from 0.005 to 0.008 in oven drying method. The highest phosphorus content of 0.008 mg/100g had been recorded in no blanching+sulfuring in both drying methods while as in sun drying method the lowest phosphorus content of 0.003 mg/100g had been recorded in no blanching+ no preservative and in oven drying method the lowest phosphorus content of 0.005 mg/100g had been recorded in blanching+ no preservative and in blanching + KMS treated fruits.

In oven drying the highest calcium content of 110.80 mg/100g was found in no blanching+ sulfuring while as the lowest calcium content of 101.67 mg/100g was found in no blanching+ no preservative in sun drying method. The highest and lowest iron contents were obtained by no blanching+ no preservative and blanching+ no preservative having values as 4.55 and 4.35 ppm in oven drying respectively. while as in sun drying method, the highest and lowest iron content were obtained by no blanching+ no preservative and blanching + no preservative treatments having values as 4.46 and 4.32 ppm respectively. The interaction between blanching, preservative, drying and their combination were found to be significant.

Sensory evaluation of dried ber showed that in oven drying method the highest and lowest scores were obtained by no blanching+ sulfuring and no blanching+ no preservative having values of 8.70 and 7.70 respectively. The mean scores of rest of the treatments in order of preference were 8.50, 8.40, 8.30 and 8.10 in no blanching+ KMS, blanching+ sulfuring,

blanching+KMS and blanching+no preservative respectively. While in sun drying method the highest and lowest scores of 8.50 and 7.38 were found in no blanching+ sulfuring and no blanching+ no preservative treatments, respectively. The results of the study revealed that oven dried fruits were organoleptically acceptable as compared to sun dried fruits.

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