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# PREPARATION OF *CHUHARA*-LIKE PRODUCT FROM BER (*Zizyphus mauritiana* Lamk.) THROUGH OSMO-AIR DRYING PROCESS

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## ABSTRACT

**Studies on the preparation of ber *chuhara* through osmo-air drying process were conducted at the Division of Post Harvest Technology, SKUAST-J, Jammu. Before making *chuhara*, the ber (*Zizyphus mauritiana* Lamk.) fruits were subjected to different pre-treatments, viz., lye peeling (5% NaOH for 5 min.), citric acid treatment (5% for 5 min.) and KMS treatment (@ 4000 ppm for 12 h). Pretreated ber were dipped in different sugar concentrations of 40, 50, 60 and 70° Brix at 24, 48 and 72 h. The treated fruits were then dried at 52±2°C for 6 h in a dehydrator till a chewable and appealing product was developed. Sensory evaluation revealed that 70°Brix at 72 h gave best *chuhara*-like product from ber through osmo-air drying process and could be an acceptable product.**

**Keywords:** Ber, *chuhara*, osmo-air drying, sugar concentration, *Zizyphus mauritiana*

## INTRODUCTION

The ber (*Zizyphus mauritiana* Lamk.) is one of the most ancient and common fruit of India. India ranks first amongst the ber growing countries of the world. Owing to its good potential for high yield and excellent economic returns, ber is grown as a commercial crop in Jammu, Punjab, Haryana and Rajasthan. Ber fruit is highly nutritive. The total area under major horticultural crops in Jammu and Kashmir State is 3.07 lakh ha, of which ber fruit crop occupies 7,820 ha with an annual production of 16,330 metric tons (Anonymous, 2009). However, the biggest constraint in ber production is fast deterioration of fruit within 10 days under ambient conditions (Pareek, 2001; Kadzere *et al.*, 2004). Ber variety '*Umran*' is very popular in *Kandi* (rainfed) belt of Jammu as it is quite remunerative and yields fodder and prunings for animal. The per hectare income generated from ber cultivation is Rs. 18,000 to 35,000 $ha^{-1}$ (Gupta, 2011). However, shelf life of ber is only 4 to 5 days which often leads to market glut. Considering this constraint and fast expansion in area under ber cultivation, the methods of its preservation and processing technology need to be developed to regulate the market for fresh fruit. Ber is generally sun-dried by the growers but the product is brown, and has shrunken appearance with poor rehydration characteristics. Therefore, the present study was aimed to develop *chuhara*-like product from ber with improved colour and appearance through use of osmo-air drying process.

## MATERIALS AND METHODS

Fully matured golden yellow coloured ber fruit cv. 'Umran' were purchased from the Vijaypur Nursery, Department of Horticulture, Jammu, located at about 40 km N-E of Jammu. Fruits were transported to

the pilot plant at Division of Post Harvest Technology, SKUAST-J, Udheywalla, J&K. The ber fruits were washed and subject to different pretreatments like lye peeling (5% NaOH for 5 min.), citric acid treatment (5% for 5 min.), potassium meta-bi-sulphite (KMS) treatment (@ 4000 ppm for 12 h). After pretreatments, the fruits were dipped in different sugar syrup concentration of 40, 50, 60 and 70° Brix with three steeping periods i.e. 24, 48 and 72 h and the products were finally dried in a dehydrator at 52±2°C (Fig. 1). The chemical analysis of products was conducted for moisture, ash, acidity (in terms

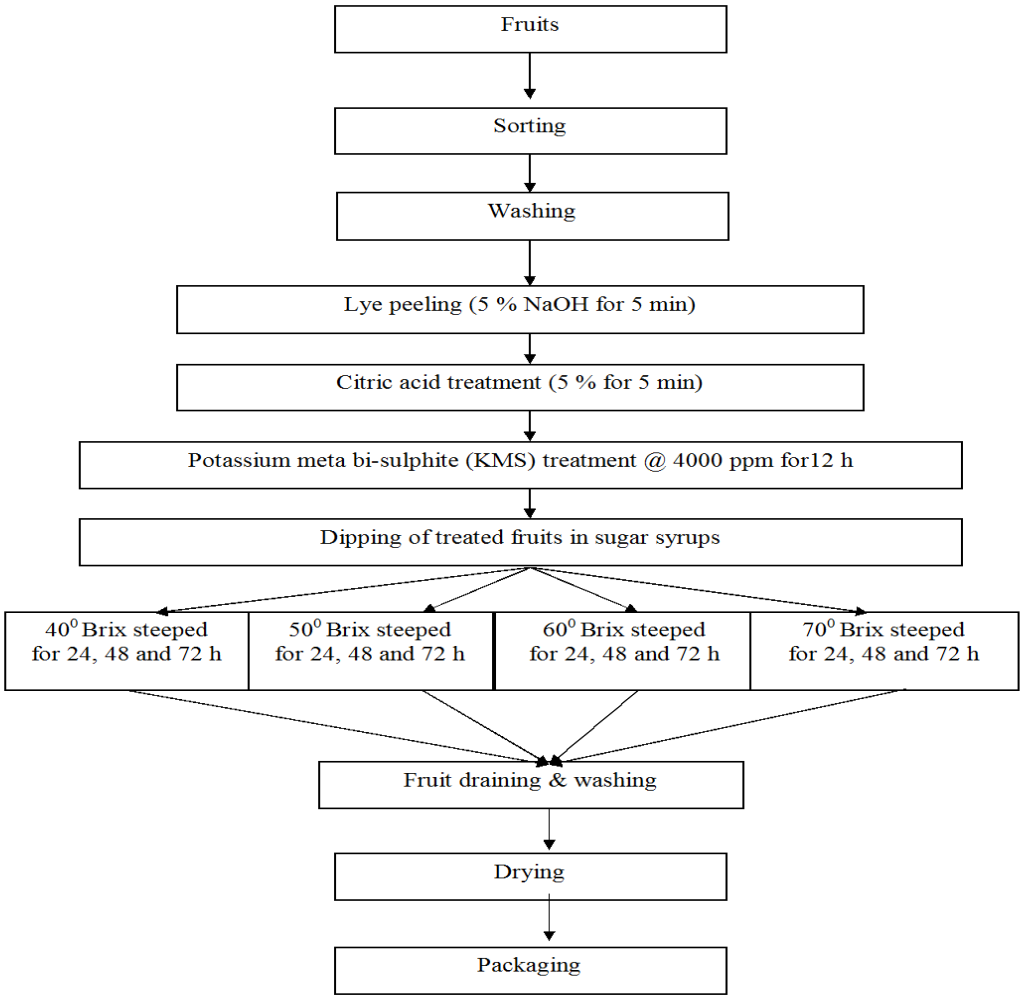


**Fig. 1: Flow chart for preparation of ber *chuhara***

of % citric acid), reducing sugars, total sugars, ascorbic acid, browning, tanning, $SO_2$, phosphorus, calcium, iron and overall acceptability using standard procedures of Ranganna (1986). The product was organo-leptically evaluated by departmental semi-trained panel members using 9 point hedonic rating with respect to colour, flavour, taste and overall acceptability. The data was analyzed statistically through analysis of variance using completely randomized design (factorial).

## RESULTS AND DISCUSSION

The moisture content of ber fruits decreased with the increase in sugar syrup concentration (from 40 to 70° Brix) as well as with different steeping time intervals (from 24 to 72 h) from 15.86 to 12.58% and 14.08 to 13.98%, respectively. The decrease was significant as far as sugar syrup concentration and

steeping time effects were concerned (Table 1). The results are in agreement with Rashmi *et al*. (2005) who while studying the osmo-air dehydration of pineapple fruit reported a loss of moisture content from 13.82 to 12.75% when sugar concentration was increased from 50 to $70^0$ Brix. The moisture loss may be attributed to the diffusion of water from dilute medium (fruits) to concentrated solution of sugar syrup (hypertonic solution) through a semi-permeable membrane until concentration equilibrium was reached. The rate of moisture removal from fruit pieces was high at $70^0$ Brix because high sugar concentrations lead to lower water potential than other concentrations. Analogue observations have been reported by Rahman and Lamb (1990), Shahbuddin and Hawaldar (1990) and Pokharkar *et al.* (1997) in other fruits.

**Table 1: Effect of different sugar syrup concentrations and time intervals (steeping period in h) on moisture, acidity, reducing sugar and total sugar of *chuhara***

| Sugar treatment | Moisture (%) | | | | Acidity (% citric acid) | | | | Reducing sugar (%) | | | | Total sugar (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (°Brix) | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean |
| 40 | 15.9 | 15.9 | 15.8 | 15.9 | 0.69 | 0.68 | 0.66 | 0.68 | 31.3 | 32.0 | 32.0 | 31.8 | 71.4 | 71.4 | 71.5 | 71.4 |
| 50 | 14.8 | 14.7 | 14.7 | 14.7 | 0.52 | 0.52 | 0.48 | 0.51 | 29.0 | 31.0 | 31.0 | 30.3 | 75.5 | 75.6 | 76.2 | 75.8 |
| 60 | 13.0 | 12.9 | 12.9 | 12.9 | 0.46 | 0.45 | 0.41 | 0.44 | 26.0 | 27.0 | 28.0 | 27.0 | 77.6 | 77.6 | 77.9 | 77.7 |
| 70 | 12.6 | 12.6 | 12.5 | 12.6 | 0.32 | 0.29 | 0.28 | 0.30 | 25.0 | 25.3 | 26.0 | 25.4 | 79.0 | 79.1 | 79.3 | 79.1 |
| Mean | 14.1 | 14.0 | 14.0 | - | 0.50 | 0.48 | 0.46 | - | 27.8 | 28.8 | 29.2 | - | 75.9 | 75.9 | 76.2 | - |
| $CD_{0.05}$ | | | | | | | | | | | | | | | | |
| Sugar syrup (S) : 0.01 | | | | | | 0.45 | | | | 0.67 | | | | 0.01 | | |
| Time (T) : 0.01 | | | | | | 0.39 | | | | 1.35 | | | | 0.01 | | |
| S x T : ns* | | | | | | 0.77 | | | | ns | | | | 0.02 | | |

*ns = non-significant

The acidity of *chuhara* showed a decreasing trend from 0.68 to 0.30% with increase in sugar concentration from 40 to 70° Brix but decline was meager during steeping from 24 to 72 h (Table 1). Interaction effect between sugar concentration and time was significant. Similar results have been reported by Rashmi *et al.* (2005) who found that with the increase in sugar concentration from 20 to 70, 30 to 70, 40 to 70 and 50 to 70° Brix the acidity of slices decreased from 0.40 to 0.30% in mango, 1.32 to 0.88% in guava, 1.12 to 0.64% in muskmelon and 1.52 to 1.34% in pine apple, respectively.

The mean reducing sugars decreased from 31.78 to 25.44% with the increase in sugar concentration from 40 to 70° Brix. These results are in conformity with Rashmi *et al.* (2005) who observed a decreasing trend in reducing sugars from 1.32 to 0.88% when sugar concentration was enhanced from 30 to 70° Brix in guava slices, from 1.12 to 0.64% (40 to 70° Brix) in muskmelon slices and from 41.8 to 37.3% (50 to 70° Brix) in pineapple slices, respectively. The total sugar content increased from 71.4 to 79.1% when sugar concentration was increased from 40 to 70° Brix. Significant differences were observed between the interaction of sugar concentration and time. The results are in agreement with Rashmi *et al.* (2005) who reported increase in total sugars from 58.9 to 65.0 (40 to 70° Brix) in muskmelon slices and 61.5 to 67.2% (50 to 70° Brix) in pineapple slices, respectively.

The ascorbic acid content was lost with increase in both the syrup concentration and steeping time intervals. The losses ranged from 60.0 to 59.0 and from 48.8 to 43.0 mg 100 $g^{-1}$ fruit when fruit was steeped for 24 to 72 h in 40 and 70° Brix, respectively. Similarly when sugar concentration was increased from 40 to 70° Brix the mean ascorbic acid content decreased from 59.7 to 46.3 mg 100 $g^{-1}$ fruit (Table 2). These findings are in consonance with the findings of Rashmi *et al.* (2005) who reported the ascorbic acid content of 91.8, 79.8 and 62.7 mg 100 $g^{-1}$ fruit in 30, 50 and 70° Brix of guava slices and 23.3, 25.8 and 21.9 mg 100 $g^{-1}$ fruit in 50, 60 and 70° Brix of pineapple slices, respectively.

A significant increase in browning was noticed with increase in syrup concentration and steeping period from 2.31 to 3.79 (OD at 440 nm) (40 to 70° Brix) and from 2.86 to 3.21 (OD, 440 nm) during 24 to 72 h (Table 2). The results are in line with the findings of Saini and Grewal (1995).

**Table 2: Effect of different sugar syrup concentrations and steeping period intervals (h) on ascorbic acid, browning, tannin and sulphur-dioxide of *chuhara***

| Sugar treatment | Ascorbic acid (mg 100 $g^{-1}$ fruit) | | | | Browning (OD at 440 nm) | | | | Tannin (mg 100 $g^{-1}$ fruit) | | | | Sulphur-dioxide (ppm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (°Brix) | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean | 24h | 48h | 72h | Mean |
| 40 | 60.0 | 60.0 | 59.0 | 59.7 | 2.16 | 2.30 | 2.46 | 2.31 | 1.56 | 1.56 | 1.56 | 1.56 | 1260 | 1215 | 1165 | 1213 |
| 50 | 57.5 | 57.5 | 57.0 | 57.3 | 2.62 | 2.78 | 2.94 | 2.78 | 1.50 | 1.48 | 1.47 | 1.48 | 1110 | 1075 | 1040 | 1075 |
| 60 | 54.6 | 54.5 | 49.0 | 52.7 | 3.02 | 3.21 | 3.48 | 3.24 | 1.40 | 1.43 | 1.42 | 1.43 | 1000 | 900 | 836 | 912 |
| 70 | 48.8 | 47.2 | 43.0 | 46.3 | 3.62 | 3.78 | 3.96 | 3.79 | 1.41 | 1.40 | 1.38 | 1.40 | 750 | 700 | 680 | 710 |
| Mean | 55.2 | 54.8 | 52.0 | - | 2.86 | 3.02 | 3.21 | - | 1.47 | 1.47 | 1.46 | - | 1030 | 972 | 930 | - |
| $CD_{0.05}$ | | | | | | | | | | | | | | | | |
| Sugar syrup (S) | : 0.45 | | | | 0.01 | | | | 0.01 | | | | 1.38 | | | |
| Time | : ns* | | | | 0.01 | | | | 0.01 | | | | 1.19 | | | |
| S x T | : ns | | | | 0.02 | | | | 0.01 | | | | 2.39 | | | |

*ns = non-significant

The highest tannin content of 1.56 mg 100 $g^{-1}$ fruit was recorded in 40° Brix sugar syrup concentration which decreased to 1.40 mg 100 $g^{-1}$ fruit when sugar concentration was increased to 70° Brix (Table 2). Interaction effect of sugar concentration and time period was significant at 5% level. The sulphur dioxide content of the product decreased with increase in syrup concentration and steeping time intervals from 1213 to 710 and 1030 to 930 ppm, respectively. The interaction between sugar concentration and steeping period was significant. The decreasing trend in sulphur dioxide was also observed by Mehta and Tomar (1980) who found $SO_2$ content of 2010, 1450 and 900 ppm in sugar concentration of 20, 40 and 70° Brix in mango slices and 1430, 1300 and 1200 ppm in sugar concentration of 30, 50 and 70° Brix in guava slices, respectively.

The ash content increased from 0.38 to 0.39% with increase in steeping period from 24 to 72 h and from 0.35 to 0.43% with increase in sugar concentration from 40 to 70° Brix (Table 3). The increase in ash content has also been reported by Kumar (2005) while studying the sustainability of different ber products.

With increase in sugar concentration from 40 to 70° Brix or steeping period from 24 to 72 h statistically negligible change in phosphorus content was noticed. The calcium content showed decrease from 103.5 to 98.6 mg 100 $g^{-1}$ fruit and iron content depicted increase from 4.31 to 4.57 ppm with increase in sugar concentration from 40 to 70° Brix (Table 3). The calcium and iron showed similar trend with increase in steeping period.

**Table 3: Effect of different sugar syrup concentrations and steeping periods (h) on ash, phosphorus, calcium and iron of *chuhara***

| Sugar treatment | Ash (%) | | | | Phosphorus (mg 100 $g^{-1}$ fruit) | | | | Calcium (mg 100 $g^{-1}$ fruit) | | | | Iron (ppm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (°Brix) | 24 | 48 | 72 | Mean | 24 | 48 | 72 | Mean | 24 | 48 | 72 | Mean | 24 | 48 | 72 | Mean |
| 40 | 0.35 | 0.35 | 0.36 | 0.35 | 0.003 | 0.003 | 0.003 | 0.003 | 103.6 | 103.5 | 103.3 | 103.5 | 4.31 | 4.31 | 4.32 | 4.31 |
| 50 | 0.37 | 0.37 | 0.37 | 0.37 | 0.003 | 0.003 | 0.002 | 0.003 | 101.8 | 101.7 | 101.6 | 101.7 | 4.40 | 4.46 | 4.50 | 4.45 |
| 60 | 0.38 | 0.39 | 0.40 | 0.39 | 0.003 | 0.003 | 0.002 | 0.003 | 100.5 | 100.3 | 100.2 | 100.4 | 4.52 | 4.52 | 4.53 | 4.52 |
| 70 | 0.43 | 0.43 | 0.43 | 0.43 | 0.002 | 0.002 | 0.001 | 0.002 | 98.8 | 98.6 | 98.4 | 98.6 | 4.56 | 4.58 | 4.59 | 4.57 |
| Mean | 0.38 | 0.39 | 0.39 | - | 0.003 | 0.003 | 0.002 | - | 101.2 | 101.0 | 100.9 | - | 4.45 | 4.47 | 4.48 | - |
| $CD_{0.05}$ | | | | | | | | | | | | | | | | |
| Sugar syrup (S) | : 0.01 | | | | ns* | | | | 0.01 | | | | 0.002 | | | |
| Time (T) | : 0.01 | | | | ns | | | | 0.01 | | | | 0.010 | | | |
| S x T | : ns | | | | ns | | | | 0.002 | | | | 0.001 | | | |

*ns = non-significant

The overall acceptability of ber fruit showed significant increase with increase in sugar syrup concentration and steeping period (Table 4). The data revealed that the product besides improving the quality of ber is acceptable.

***Conclusions:*** The *chuhara*-like product from prepared from ber (*Zizyphus mauritiana* Lamk.) through use of osmo-air drying process. The product has better quality attributes and sensory evaluation revealed that sugar treatment at 70°Brix with steeping period of 72 h gave best acceptable product.

**Table 4: Effect of various sugar syrup concentrations and steeping periods on the sensory score of overall acceptability of *chuhara***

| Sugar syrup treatments (°Brix) | Steeping periods (h) | | | |
|---|---|---|---|---|
| | 24 | 48 | 72 | Mean |
| 40 | 6.00 | 6.10 | 6.20 | 6.10 |
| 50 | 6.80 | 6.90 | 7.20 | 6.97 |
| 60 | 7.70 | 8.00 | 8.10 | 7.93 |
| 70 | 8.07 | 8.20 | 8.30 | 8.19 |
| Mean | 7.14 | 7.30 | 7.45 | - |
| $CD_{0.05}$ | Sugar syrup (S) : 0.11 | | | |
| | Time (T) : 0.10 | | | |
| | S x T : ns* | | | |

*ns = non-significant

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