

## **PRESERVATION OF JACKFRUIT (*Artocarpus heterophyllus*) BY OSMOTIC DEHYDRATION**

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### **Abstract**

Preservation of jackfruit (*Artocarpus heterophyllus*) by osmotic dehydration method has been standardized. Four treatments of sugar concentration viz. 35<sup>o</sup>, 40<sup>o</sup>, 45<sup>o</sup>, and 50<sup>o</sup> Brix were used for osmotic dehydration. After osmosis of the jackfruit slices in the sugar solutions these were laid on the cabinet drier for dehydration. After osmotic dehydration, the products were packed in high density polyethylene bags and stored in ambient temperature for a period of 8 months. The physico-chemical properties and the microbiological changes of the products were evaluated and a taste panel evaluated the organoleptic quality of the products during the storage period. Minimum microbial count was recorded for osmosis in 50<sup>o</sup> Brix sugar solution followed by 45<sup>o</sup> Brix sugar solution. The retention of vitamin A (β-carotene), vitamin C, total acid and total sugar was also better for osmosis in 45<sup>o</sup> Brix sugar solution followed by 50<sup>o</sup> Brix sugar solution. The product of 45<sup>o</sup> Brix solution when stored 8 months at room temperature secured highest score in organoleptic evaluation and was ranked “like moderately” followed by the product of 50<sup>o</sup> Brix solution. Considering the overall acceptance of sensory evaluations, retention of nutritional quality and quantity of sugar needed, the osmotic dehydrated jackfruit prepared by 45<sup>o</sup> Brix sugar solution could be selected for commercial processing.

Keywords: jackfruit preservation, osmotic dehydration.

### **Introduction**

The jackfruit (*Artocarpus heterophyllus*) has been named as the national fruit of Bangladesh. It is one of the largest fruits to grow on trees in the world, and a jackfruit tree can live and bear fruit for approximately a hundred years if taken care of correctly (Anon., 2011).

The climate in Bangladesh is perfect for the cultivation of jackfruit trees and in addition to its nutritional value; the Jackfruit is an inexpensive fruit and can be bought or grown in the poorest communities. The size of the fruit also adds to its value, but is unfortunately known to be somewhat of an acquired taste to some people. Jackfruit in Bangladesh is viewed as delicious, sweet, tasty, and juicy.

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Many people use jackfruit in unripe stage for their curries and other cuisine. It could be made into a variety of different products, such as canned fruit, dried fruit and pulp. The total production of jackfruit in Bangladesh is about 925.97 thousand metric tons from 24.654 thousand acres of land (BBS, 2007) and they are characterized by their perishability and seasonality. Postharvest losses of this fruit are very high due to lack of storage facilities and mishandling operations. Bangladesh produces over 10.81 million tons of fruits and vegetables (BBS, 2007). There is estimation that only 0.5% of the horticultural produces are processed (Tongsiri and Alam, 2004). Most of the fruits and vegetables are seasonal. During the peak season they appear in the market and form glut to abundant supply at a time and the price comes down causing economic loss to the growers. All these factors discourage the growers from producing more. So reduction of postharvest losses and increases of their shelf life has become an urgent need in order to extend their availability round the year. Processing and preservation can play a vital role in reducing postharvest losses of fruits and vegetable and make them available during off-season.

Osmotic dehydration, a method of preservation has the advantage of being very easy to perform for home and small scale processing. Now a day, there is a huge demand for dried fruits both in domestic as well as in foreign markets. Osmotic dehydration if optimized will reduce losses, improve availability and allow diversification of processed product. It also will add value to the most abundant fruit of Bangladesh.

### **Materials and Method**

The jackfruits were washed, peeled, removed the seed from bulb and sliced length wise. There were four treatments comprising of four concentration of sugar syrup as follows:

$T_1 = 35^0$  Brix sugar syrup

$T_2 = 40^0$  Brix sugar syrup

$T_3 = 45^0$  Brix sugar syrup

$T_4 = 50^0$  Brix sugar syrup

So, slices of the jackfruits were divided into four groups and dipped into the sugar syrup concentrations and kept 30 minutes for soaking. Then, the slices were heated at 80°C for 45 minutes. Finally, the slices were kept for 3 hrs again for soaking and 2000 ppm potassium metabisulphite (KMS) were added according to FPO specification (Ranganna, 2007). The slices were transferred to drying trays and dehydrated at 50°C for 24hrs, 55°C for 24hrs and finally 60°C for 8hrs. The time and temperature of drying of the jackfruit slices in the mechanical dryer was fixed up after several trials. After dehydration, the slices were packed in high density polyethylene packet and stored at ambient

temperature. The stored samples were analyzed at monthly intervals for moisture, acidity, total and reducing sugars as per method described by Ranganna (2007),  $\beta$ -carotene by NIN procedure and ascorbic acid by the procedure described by Mahadevan and Sridhar (1982). Microbial load (bacteria, fungi and yeast) was estimated in the stored osmotic dehydrated jackfruit by the method described by Istavan Kiss (1984) at monthly intervals by adopting pour plate method using serial dilution technique.

### **Sensory evaluation**

Stored osmotic dehydrated jackfruits were examined by a panel of 10 judges comprising of scientific staff for their color, flavor/taste, texture/stickiness and overall acceptance. Hedonic scale was used to make the different parameters. In this scale 'like extremely', is given the highest score of 9 and 'dislike extremely' is given the lowest score 1. Others are given intermediate scores. The data were analyzed for ANOVA in completely randomized design (CRD) under computerized statistical methods of M-stat and Duncan's Multiple Range Test (DMRT) was used to compare the means.

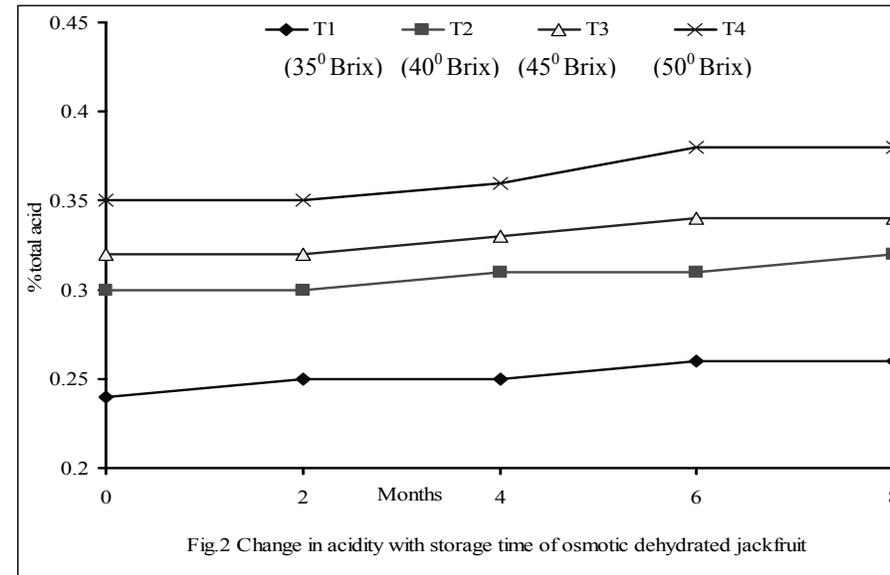
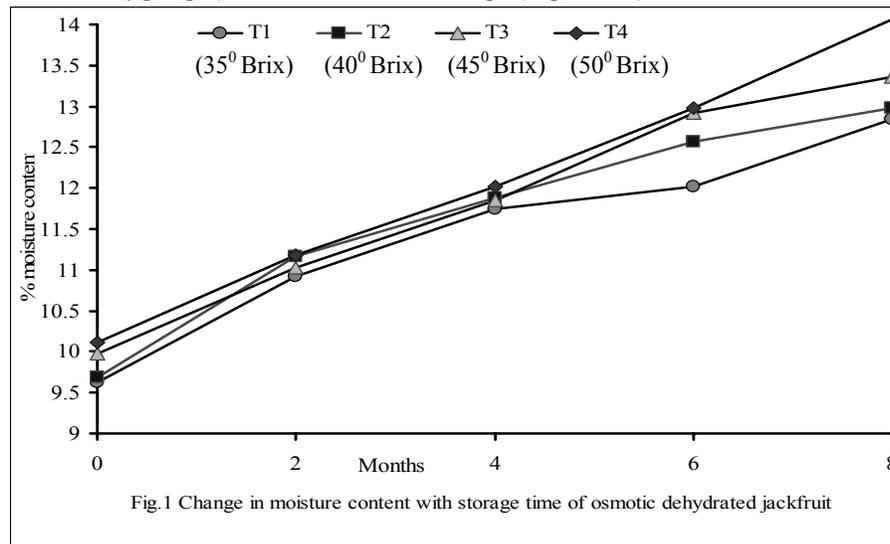
### **Results and Discussion**

The prepared osmotic dehydrated jackfruit is not suitable for consumption immediately after drying due to its stickiness and hardness. The stickiness of the product that is assumed to be the critical sensory attributes remains high at the beginning of preparation. It was observed that storage time is essential for seasoning for the improvement of stickiness and hardness of the osmotic dehydrated jackfruit slices.

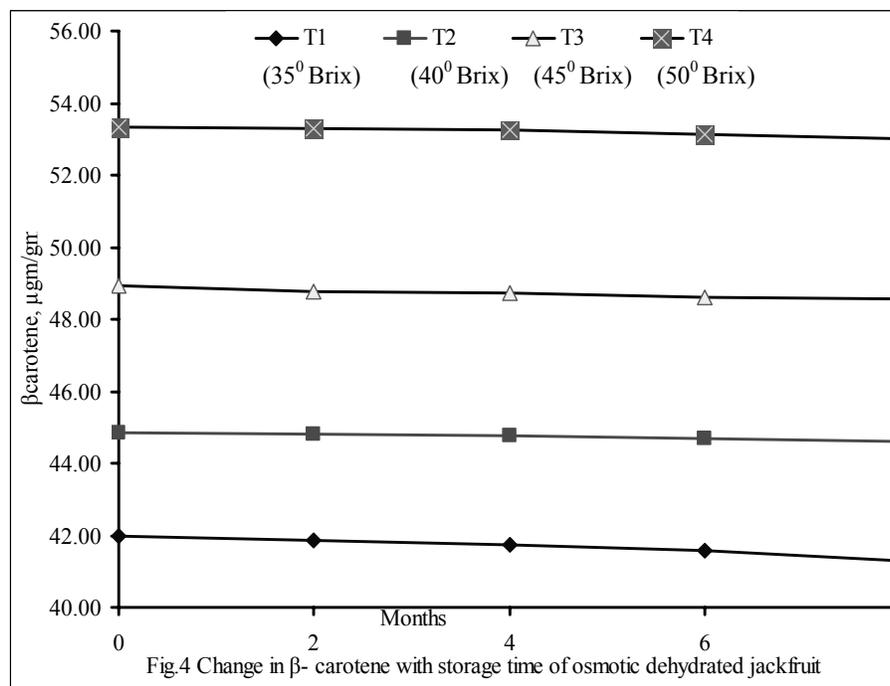
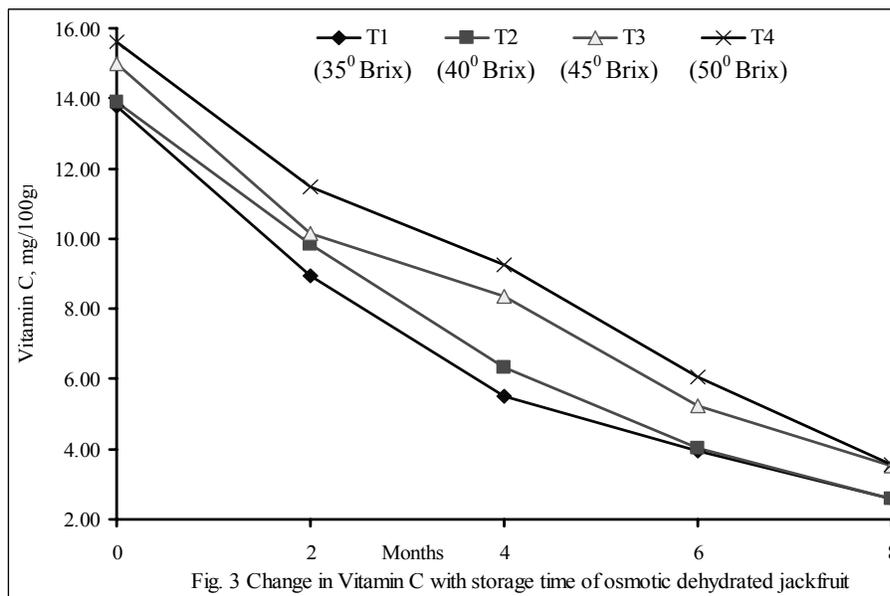
The changes in various physico-chemical parameters of the dehydrated jackfruits stored in ambient temperature are presented in Fig.1 to 6. The data for each chemical change was collected at each month but for convenience the initial, 2, 4, 6 and 8 months of storage have been considered for discussion. The results indicate that the moisture content of the osmotic dehydrated jackfruit increased in all treatments. This increase could be due to the higher relative humidity (85-95% in the rainy season) during the storage period of the products. The higher moisture content was observed in the osmotic dehydrated jackfruit prepared from 50<sup>0</sup> Brix sugar syrup i.e. T<sub>4</sub> (14.06%) followed by osmotic dehydrated jackfruit prepared from 45<sup>0</sup> Brix sugar syrup i.e. T<sub>3</sub> (13.36%) after a period of 8 months storage (Fig 1). Because of increase in moisture content of the osmotic dehydrated jackfruit the change in acidity is vary small (Fig. 2).

A remarkable reduction was noted in ascorbic acid (vitamin C) and  $\beta$ -carotene (vitamin A) contents of the samples during storage. The reduction could be due to both oxidative and non-oxidative changes as described by Eskin (1979) and Land (1962). Such changes altered the color of the product and lowered the

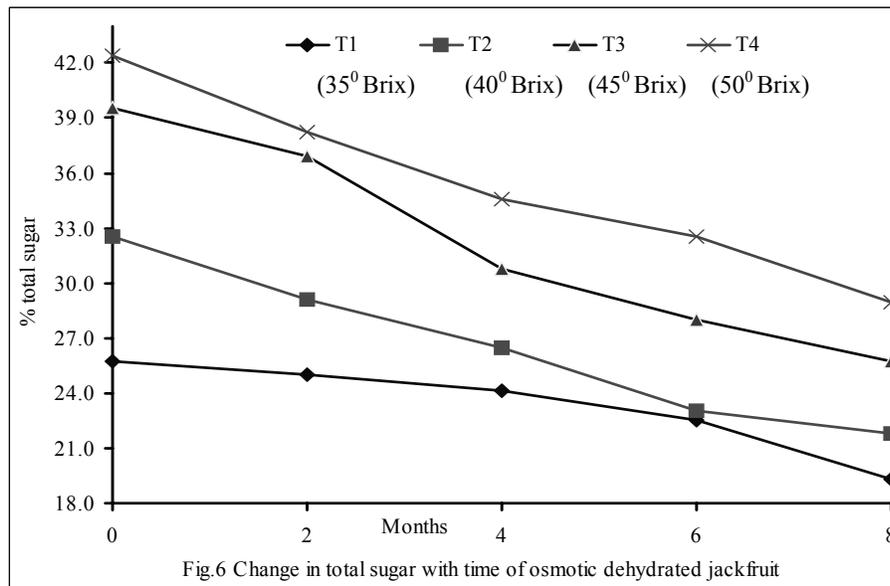
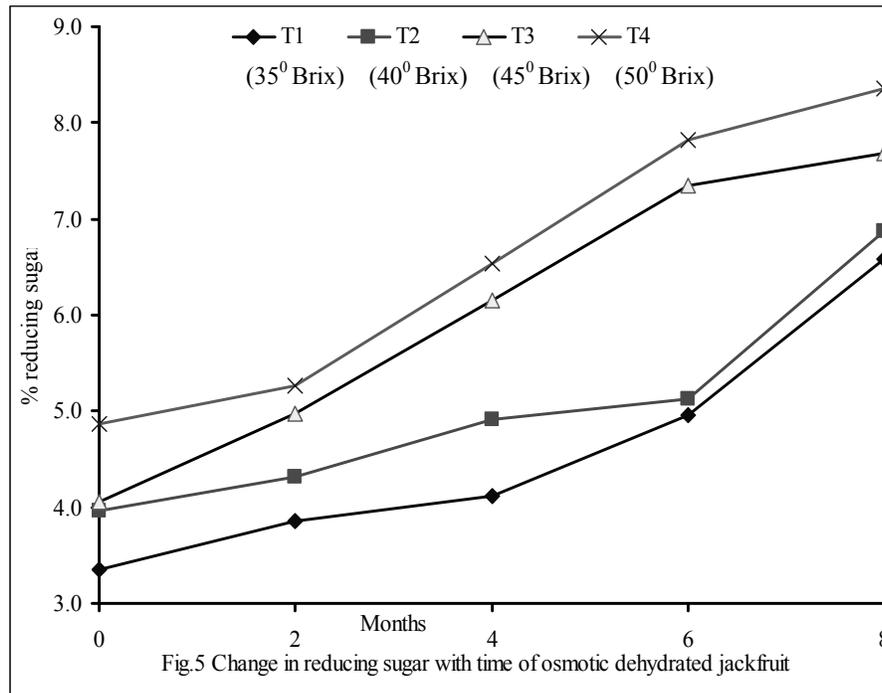
flavor and nutritive value of the product. The maximum retention of vitamin C and  $\beta$ -carotene were observed in osmotic dehydrated jackfruit prepared from 50<sup>0</sup> Brix sugar syrup i.e. T<sub>4</sub> (3.56 mg/100g and 53.02  $\mu$ gm/gm) followed by osmotic dehydrated jackfruit prepared from 45<sup>0</sup> Brix sugar syrup i.e. T<sub>3</sub> (3.54 mg/100g and 48.56  $\mu$ gm/gm) after 8 months of storage (Fig. 3 & 4).



NB. T<sub>1</sub> = 35<sup>0</sup> Brix sugar syrup, T<sub>2</sub> = 40<sup>0</sup> Brix sugar syrup, T<sub>3</sub> = 45<sup>0</sup> Brix sugar syrup, T<sub>4</sub> = 50<sup>0</sup> Brix sugar syrup



NB. T<sub>1</sub> = 35° Brix sugar syrup, T<sub>2</sub> = 40° Brix sugar syrup, T<sub>3</sub> = 45° Brix sugar syrup, T<sub>4</sub> = 50° Brix sugar syrup



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The total sugar content was decreased and reducing sugar was increased in all the treatments of the osmotic dehydrated jackfruit after a storage period of 8 months (Fig. 5 & 6). Decrease in total sugars in osmotic dehydrated jackfruit might be due to the significant increase in reducing sugars (Mir and Nath 1993) by acid hydrolysis of total and non-reducing sugars and thereby inversion of total (Rao and Roy 1980) and non-reducing sugars to reducing sugars (Meyer 1966; Roy and Singh 1979).

The bacteria, fungi, and yeast population enumerated during storage is presented in Table 1. The microbial counts of the osmotic dehydrated jackfruits of various sugar concentrations was nil initially and increased slightly during storage. No microorganism was traceable initially due to the higher dilution used for the enumeration. Osmotic dehydrated jackfruit prepared by 50<sup>0</sup> brix sugar solution and 45<sup>0</sup> brix sugar solution showed minimum of microbial counts than that prepared by 35<sup>0</sup> and 40<sup>0</sup> brix sugar solution during storage in high density polyethylene packet at ambient condition. Osmotic dehydrated jackfruit slices prepared by 35<sup>0</sup> brix sugar solution exhibited slightly higher microbial population than the rest of the slices. In general, the microbial population of the jackfruit slices prepared for the experiment was quite low even at the end of 8 month of storage though there was a significant increase in moisture content over the period. The higher concentration of sugar in the syrup and the preservative (KMS) added, while preparing the jackfruit slices coupled with still low moisture content following storage (maximum 14% m.c.), might have prevented the growth of microbes.

**Table 1. Microbial population (CFU) of osmotic dehydrated jackfruit during storage.**

Storage periods (months)	Bacteria				Fungi				Yeast			
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	2	1	1	1	1	1	1	1
4	3	3	3	2	3	2	2	2	2	1	1	1
6	3	2	2	2	3	2	2	2	2	1	1	1
8	8	6	5	5	6	4	3	3	4	3	2	2

T<sub>1</sub> = 35<sup>0</sup> Brix sugar syrup      T<sub>2</sub> = 40<sup>0</sup> Brix sugar syrup  
 T<sub>3</sub> = 45<sup>0</sup> Brix sugar syrup,      T<sub>4</sub> = 50<sup>0</sup> Brix sugar syrup

The osmotic dehydrated jackfruit was organoleptically evaluated after every 2 months of storage period. But for the discussion, the 6 months and 8 months storage data have been taken. After 6 and 8 months of storage the highest overall

acceptance score was obtained for treatment T<sub>3</sub> (7.7 and 7.5) followed by treatment T<sub>4</sub> (6.9 and 6.8), respectively as shown in the Table 2. It is noticed that nobody disliked the products even after 8 months of storage at ambient temperature.

**Table 2. Sensory scores of osmotic dehydrated jackfruit.**

Treat-ments	Sensory/organoleptic attributes after 6 months of storage				Sensory/organoleptic attributes after 8 months of storage			
	Color	Taste/flavour	Stickiness /texture	Overall acceptability	Color	Taste/flavour	Stickiness/ texture	Overall acceptability
T <sub>1</sub>	8.2a	5.7c	4.7c	5.4d	7.5a	6.2d	5.3d	5.8d
T <sub>2</sub>	7.6b	5.8c	5.3b	6.3c	7.2b	6.4c	6.1c	6.1c
T <sub>3</sub>	7.3b	7.4a	7.4a	7.7a	6.9c	7.9a	7.8a	7.5a
T <sub>4</sub>	6.2c	6.6b	7.6a	6.9b	5.5d	7.2b	6.9b	6.8b
CV (%)	2.26	2.6	3.36	3.03	1.48	1.44	1.77	1.53

Mean scores having the same letter suffix do not differ significantly at 5% (\*) level of probability (DMRT)

Treatment:

T<sub>1</sub> = 35<sup>0</sup> Brix sugar syrup

T<sub>2</sub> = 40<sup>0</sup> Brix sugar syrup

T<sub>3</sub> = 45<sup>0</sup> Brix sugar syrup

T<sub>4</sub> = 50<sup>0</sup> Brix sugar syrup

1 = Dislike extremely,

3 = Dislike moderately,

5 = Neither like nor dislike,

7 = Like moderately,

9 = Like extremely

Hedonic scale indicating score:

2 = Dislike very much,

4 = Dislike slightly,

6 = Like slightly,

8 = Like very much,

So, we can conclude that considering the physico-chemical changes, overall acceptance of sensory evaluations and sugar quantity needed for the syrup, the treatment T<sub>3</sub> i.e. 45<sup>0</sup> Brix sugar syrup could be selected for commercial processing of osmotic dehydrated jackfruit.

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