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Effect of storage studies on chemical composition of osmo-dried pear slices

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Abstract
A study was conducted to evaluate the effect of storage periods on osmotically dehydrated pear slices. Peeled pear slices were subject to osmotic pretreatment (60% Glucose + 0.5% KMS) for 18 hours. Pretreated pear slices were cabinet dried at 50°C till desired moisture content. Dried pear slices were analyzed for proximate composition at 0, 90 and 180 days of storage at ambient conditions. Results indicated that the moisture content and reducing sugars increased significantly ($p \leq 0.05$) during storage. However, titratable acidity and total sugars decreased during storage.

Keywords: Pear, Proximate composition, Osmotic dehydration, Storage

Introduction
Pear (Pyrus communis L.) is a fruit of temperate regions. It is the most important existing species of the fruit. The flavor of the pear is associated with its sugar content. Pear's pH varies from 2.6 to 5.4, where citric and malic acids are preponderant. Its bitter taste is usually associated with the rind, due to the phenolic and polyphenolic substances. The volatile aromatic compounds contribute to the flavor. (Pattee, 1985) [13]. The common processing techniques of pears are conserves in syrup, purees for use in nectars, yogurts and drying (Guiao, 1964) [6]. The osmotic dehydration is a method of preservation of fruits and consists in the immersion of fruits in hypertonic solutions. Using sugar solutions as the osmotic agent gives rise to two simultaneous flows: sugar diffuses from the solution into the food and water diffuses out of the fruit into the solution. This is a method used for attaining better quality fruits and it is used as a preliminary drying period (Adambounou *et al.* 1983) [1]. The objective of the present investigation was to study the effect of storage periods on osmotically dried pear slices.

Material and methods
Freshly harvested Pear (Bartlett) were procured from market and sorted properly. Peel was removed and pear were slices to thickness of 10mm. The slices were then subjected to osmotic treatment (60%Gucose+0.5%KMS) for 18 hours. Pretreated pear were then dried in cabinet drier at 50°C till the moisture content reached 11-12%. Dried pear were packed in polypropylene boxes and stored for 180 days at ambient conditions. The osmo dried pear were analyzed for proximate composition at 0, 90 and 180 days of storage and compared with sundried slices (control) of same variety.

Moisture (%)
Moisture content was estimated by the method described by AOAC (1965) [3]. Weighed 5 g sample in triplicate were dried in hot air oven at 70ºC±5ºC in pre-weighed dishes for 12 hour till constant weight. The dishes with dried sample were transferred to a desiccator and cooled to room temperature. The dishes were then weighed and moisture content in per cent was calculated from loss in weight.

$$\text{Moisture (\%)} = \frac{\text{Initial weight (g)} - \text{Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

Titratable Acidity (%)

The titratable acidity was estimated by titrating 5 ml of sample against 0.1N NaOH solution using phenolphthalein as an indicator. The acidity was calculated and expressed as per cent anhydrous malic acid (FAO, 2001) [5].

Reducing sugars (%)

Reducing sugars were estimated by phenol sulphuric acid method (Dubois *et al.,* 1956) [4]. Ground pear 100 mg was hydrolysed by keeping in boiling water bath for 3 hrs with 5 ml of 2.5N HCl and cooled to room temperature. The solution was neutralized with solid Na_2CO_3 until the effervescence ceased and the volume was made up to 100 ml with distilled water the contents were then centrifuged at 8000 rpm for 30 min at 27°C. 1 ml of supernatant was diluted to 100 ml with distilled water. About 1 ml diluted sample was transferred in test tube and 1ml of 5 per cent phenol, 5 ml of concentrated sulphuric acid was added. The mixture was shaken well and kept in water bath maintained at 30 °C for 20 min. The absorbance of the solution was measured at 490 nm in spectrophotometer. Reducing sugar in test sample was calculated using standard graph prepared with standard solution of glucose.

Total sugars (%)

Total sugars were determined by the methods described by Ranganna (1986) [14] with slight modifications. To a known quantity of sample (10 ml or 10 g), 10 ml of 45% lead acetate solution was added and after 15 to 20 min, 5 g potassium oxalate was mixed. The content was filtered through Whatman No. 41 filter paper and the volume of the filtrate was made up to 100 ml with water. 75 ml of this filtrate was titrated against Fehling's solutions A and B (5 ml each) using methylene blue as indicator. The remaining 25 ml filtrate was mixed with 5 ml conc. HCl and kept overnight. It was then, neutralized with 10% NaOH solution using phenolphthalein as an indicator. The volume of this pink coloured solution was made up to 75 ml and then, titrated against Fehling's solutions A and B (5 ml each).

$$\text{\% Total sugar (as invert sugars)} = \frac{0.05 \times V_1 \times V_2 \times 100}{T_2 \times W \times 25}$$

Where,
V_1 = Volume of the extract made up to 100 ml,
V_2 = volume made up after neutralization,
T_1 = 1st titre value;
T_2 = 2nd titre value,
W = weight of sample taken.

Results and discussion

The results for moisture, titratable acidity, reducing sugars and total sugars at storage periods of 0, 90 and 180 days are presented in table 1. Analysis of data revealed that storage periods significantly influenced the moisture content of osmodried pear slices during ambient storage period of 180 days. Highest mean moisture content of 13.46 per cent was recorded in sundried pear slices from treatment T_1 (control) and the lowest 12.74 per cent in peeled slices from treatment T_2 (60% Glucose+0.5% KMS) cabinet dried at 50°C. Moisture content increased significantly with the increase of storage periods. Initially mean moisture content of 11.40 per cent was recorded at 0 days of storage which increased to 12.59 and 15.32 per cent at 90 and 180 days of storage. Interaction effect between storage periods and treatments was also found to be significant. However maximum moisture content of 15.93 per cent was recorded from treatment T_1 at 180 days of storage and minimum of 11.00 per cent was recorded from treatment T_2 at 0 days of storage. Increase in moisture content during storage might be due to hygroscopic nature of the product and ingress of air and vapours through packaging material. The results are in agreement with Sra *et al.* (2014) [17] who reported an increase in moisture content during storage of dried carrots. Similar results were reported by Sharma *et al.* (1991) [16] in apple rings and Sharma *et al.* (2000) [15] in osmo-dried apricot.

The storage periods did not influence significantly the titratable acidity of osmo-dried pear slices during ambient storage period of 180 days. Maximum titratable acidity 0.51 per cent was recorded in sundried pear slices from treatment T_1 (control) and minimum 0.45 per cent in peeled pear slices from treatment T_2 (60% Glucose+0.5% KMS) cabinet dried at 50°C. Titratable acidity of pear slices decreased with the increase in storage periods. Initially mean titratable acidity of 0.53 per cent was recorded at 5 days of storage which decreased to 0.49 and 0.42 per cent at 90 and 180 days of storage. Interaction effect between storage periods and pretreatments was found to be non-significant. However maximum titratable acidity of 0.57 per cent was recorded from treatment T_1 at 0 days of storage and minimum of 0.40 per cent was recorded from treatment T_2 at 180 days of storage.

Table 1: Effect of storage periods on moisture, titratable acidity, reducing sugars and total sugars of osmodried pear slices.

Treatments \ Storage	Moisture (%)				Titratable acidity (%)				Reducing sugars (%)				Total sugars (%)			
	0 d (S_1)	**90 d (S_2)**	**180 d (S_3)**	**Mean**	**0 d (S_1)**	**90 d (S_2)**	**180 d (S_3)**	**Mean**	**0 d (S_1)**	**90 d (S_2)**	**180 d (S_3)**	**Mean**	**d (S_1)**	**90 d (S_2)**	**180 d (S_3)**	**Mean**
T_1 (control)	11.80	12.67	15.93	13.46	0.57	0.52	0.45	0.51	33.55	34.84	34.98	34.45	48.75	47.13	46.95	47.61
T_2 (Glucose + KMS)*	11.00	12.52	14.72	12.74	0.50	0.47	0.40	0.45	34.80	35.75	36.93	35.82	49.56	49.34	47.60	48.83
Mean	11.40	12.59	15.32		0.53	0.49	0.42		35.17	35.29	35.95		49.15	48.23	47.27	
CD $p \leq 0.05$																
Storage (S)	0.14				NS				0.09				0.08			
Treatment (T)	0.11				NS				0.07				0.06			
S x T	0.20				NS				0.17				NS			

Decrease in titratable acidity might be due to utilization of acids for conversion of non-reducing sugars to reducing sugars. Kaushik (1997) [8] also reported that the conversion of acids into sugars resulted in lowering the acidity during storage and this decrease might be due to chemical interaction between organic constituents of the fruit induced by the action of enzymes and storage temperature. Reduction of titratable acidity during osmosis have also been reported by Gupta

(2007) [7] in ber churhara which could be assumed due to leaching of acids during osmosis. Similar finding have been reported by Kumar (2013) [9] in osmo-dried plum.

Regarding the reducing sugars, the results revealed that storage periods significantly influenced the reducing sugars of osmo-dried pear slices during ambient storage period of 180 days. Highest reducing sugars 35.82% was recorded in peeled pear slices from treatment T_2 (60% Glucose+0.5% KMS) cabinet dried at 50°C and lowest 34.45% in sundried slices from treatment T_1 (control). Reducing sugars of the slices increased significantly with the increase of storage periods. Initially mean reducing sugars of 35.17 per cent was recorded at 0 days of storage which increased to 35.29 and 35.95 per cent at 90 and 180 days of storage. Interaction effect between storage periods and treatments was also found to be significant. However maximum reducing sugars of 36.93 per cent was recorded from treatment T_2 at 180 days of storage and minimum of 33.55 per cent was recorded from treatment T_1 at 0 days of storage. Increase in reducing sugars during storage might be due to hydrolysis of polysaccharides and inversion of non-reducing sugars to reducing sugars. The results are in accordance with those obtained by Amitabh and Tomar (2000) [2] in mango slices, Muzzaffer (2006) [10] in pumpkin candy, Naikwadi *et al.* (2010) [11] in dehydrated fig and Synrem (2013) [18] in bamboo shoot candy.

Highest total sugars 48.83% was recorded in peeled pear slices from treatment T_2 (60% Glucose+0.5% KMS) cabinet dried at 50°C and lowest 47.61% in sun dried slices from treatment T_1(control). Storage periods significantly influenced the total sugars of osmo-dried pear slices during ambient storage period of 180 days. Total sugars of the slices decreased significantly with the increase of storage periods. Initially mean total sugars of 49.15 per cent was recorded at 0 days of storage which decreased to 48.23 and 47.27 per cent at 90 and 180 days of storage. Interaction effect between storage periods and treatments was also found to be significant. However maximum total sugars of 49.56 per cent was recorded from treatment T_2 at 0 days of storage and minimum of 46.95 per cent was recorded from treatment T_1 at 180 days of storage. Reduction in total sugar content indicates the possibility of their participation in biochemical and browning reactions. Nanjundaswamy *et al.* (1978) [12] reported similar trends of decrease in total sugars in dehydrated pineapple, papaya and apple segments. Sharma *et al.* (2000) [15] also reported decrease in total sugars in osmo-air dried apricots during storage.

Conclusion

Statistically significant effect of storage periods was observed on moisture content, reducing sugars and total sugars. However, the effect of storage on titratable acidity was found to be non-significant.

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