



Physical and qualitative characters of date palm (*Phoenix dactylifera* L.) fruits stored under freeze condition

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Date palm (*Phoenix dactylifera* L.) is a nutrient rich fruit crop. Iraq is the center of origin of date palm and it is reported that it is cultivated from more than 6000 years ago. Date palm fruit rich in essential nutrients, vitamins, and minerals which help in enhance the growth and development of human body. It contains 70–80% carbohydrates (fructose and glucose) and minerals like calcium, iron, magnesium, phosphorus, potassium, zinc, selenium and manganese which enhance their nutritional values. Aqueous extracts of date have a potential antioxidant and anti-mutagenic property (Saafi *et al.*, 2009). It is rich source of vitamins, especially β -carotene, thiamine, riboflavin, niacin, ascorbic acid and folic acid (El Hadrami *et al.*, 2011). The major date palm growing areas in India are Kutch (Gujarat), western part of Rajasthan, and certain parts of the Punjab, as well as Tamil Nadu. Area of date palm in Rajasthan is 850 ha with production of 800 tonnes (Singh, 2018). It is well known fact that quality deteriorates at ambient temperature after some days of harvesting. However, frozen storage can be utilized in some fruits and vegetables for long time storage. It enhances the shelf life of produce by decreasing the water activity, inhibits microorganism growth and reduces enzymatic activity (Fellows, 2000). Therefore, present study was planned to evaluate the impact of freeze storage on fruit quality characters of date palm and compare the quality parameter of fresh and stored fruits.

The experiment was conducted during July 2019 to July 2020 at College of Agriculture, SKRAU, Bikaner on “Halawy” cultivar of date palm. Fruits were harvested at doka stage. For each observation 30 random fruits were taken. At the time of harvesting, fruits were taken from uniform bunches. Fruits were packed in net bags and stored in deep freeze at -20°C temperature for period of 12 months. Fruits were thawed before taking observations; fruits were taken from the freeze and leave them for 2 hours at room temperature for thawing. Fruits weight, pulp weight and stone weight of fresh and stored fruit at doka stage were recorded. Fruit length and diameter were observed by using vernier caliper and then mean values calculated. Total soluble solids (TSS) were determined by using digital hand refractometer ($0-50^{\circ}$ Brix). The value was corrected at 20°C and expressed as $^{\circ}$ Brix (A.O.A.C., 2007). The titrable acidity of the juice was determined by titrating it against 0.1 N NaOH, using

phenolphthalein indicator and it was expressed in % malic acid (A.O.A.C., 2007). However, ascorbic acid content was determined by the method reported earlier by Ruck (1969). Ten ml of juice was diluted with 0.4% oxalic acid solution and 5 ml of filtered aliquot was titrated against 2, 6-dichlorophenol indophenol dye to light pink colour end point and were determined as mg 100 ml⁻¹ FW. The total sugar content determine by Anthrone reagent method (Hedge, 1962). Reducing sugar content was measured by following “Nelson's modification” of “Somogyi method” (Somogyi, 1952) using aresenomolybdate colour forming reagent and two copper reagent “A” and “B”. The non-reducing sugars were calculated by the deducting the reducing sugar content from the total sugar content and multiplied by the factor 0.95.

Physical parameters

The data obtained on physical parameters are presented in Table 1. The average fruit weight of 30 fresh fruits was found 7.42 g. The weight of fruits decreases after 12 months in deep freeze storage at -20°C temperature. Initial weight of fresh date fruits at doka stage found 6.20 g and it is also reduces from 6.20 to 3.99 g after 12 months. Stone weight of fruit initially observed 1.22 g and after deep freeze storage slightly loss in weight was found from 1.22 to 1.19 g. Reduction in the weight occurs due to chemical reaction and water loss during storage period. This finding supported by the work of Yousef *et al.*, (2012) in mango and they found rapid moisture loss in mango during storage. Length and diameter of the fresh fruit observed 3.87 and 1.92 cm which reduced after storage period to 2.98 and 1.33 cm, respectively. Reduction in the length and diameter occurs due to shrinkage in fruit skin. This result confirm with the finding of Al-Yahyai and Al-Kharus (2012).

Quality parameters

The data observed on quality parameters are given in Table 1. Total soluble solids in fresh fruit of Halawy cultivar found $47.52^{\circ}\text{B}^{\circ}$ and it was increase in storage condition up to $52.62^{\circ}\text{B}^{\circ}$. The similar trends were observed by Yousef and Labib (2007) on apricot and Zina (2000) and Shatta (2006) on lime. TSS increased in mango irrespective to storage period (Islam, et al., 2013). Acidity of the date palm fruits were

decreased from 0.42% to 0.34% during storage. It is commonly attributed to consumption of organic acids for energy production (Cohen *et al.*, 1990). Previous studies also get similar results, where temperature and storage reduced the acidity (Porat *et al.*, 2000). Fresh fruit contain high ascorbic acid and it was reduced with the storage period from 6.41 to 4.21 mg/100g. Loss in ascorbic acid carried out by the oxidation process (El-Ishaq, and Obirinakem, 2015) and vitamin C also reduced at 4°C temperature in 14 days storage of orange (Galani *et al.*, 2017).

Total, reducing and non reducing sugars were enhance at -20°C after 12 months storage which is 32.79%, 29.64% and 3.15%, respectively as compared to fresh fruit that was 28.42%, 25.47% and 2.95%, respectively. This phenomenon occurs due to slow rate of respiration metabolism in date fruit. Invertase enzyme play major role in changing the amount of sugars in date palm under freeze storage condition. Al- Redhaiman (2005) also reported that under storage total sugar was increased in cv. Barhee. In date

palm Barhee cultivar at -40 °C, the glucose and fructose percentages increased at slow and regular rate under storage (Alhamdan *et al.*, 2018). Increase in the reducing sugars (fructose and glucose) was also observed by Al-Mashhadi *et al.* (1993). Sugars were increased in stored fruits of mango (Islam *et al.*, 2013).

Date palm fruit contain high amount of sugars (30 to 44% at doka stage) therefore, spoiled due to fermentation process at room temperature. The shelf life of date fruits can be enhanced by stored fruits under low temperature. Amount of sugar and TSS were enhanced in storage however, acidity and ascorbic acid were reduced. Texture of the fruit somewhat changed due to water loss and shrinkage but these fruits contain good amount of TSS, ascorbic acid, sugars and acidity. These fruits remain consumable after 12 months storage and these are used as preparation of value added products like jam, biscuits, dry dates and soft dates *etc.* and other date based products.

Table 1. Physical and quality characters of date palm cv. Halawy cultivar at Doka stage

Characters	Fresh fruits	Stored fruits (-20°C)
Fruit weight (g)	7.42	5.18
Pulp weight (g)	6.20	3.99
Stone weight (g)	1.22	1.19
Diameter(cm)	1.92	1.33
Length (cm)	3.87	2.98
TSS B°	47.52	52.62
Acidity %	0.42	0.34
Ascorbic acid (mg/ 100g)	6.41	4.21
Total sugar %	28.42	32.79
Reducing sugar %	25.47	29.64
Non reducing sugar %	2.95	3.15

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