



FULL LENGTH ARTICLE

# Effect of postharvest hot-water and heat treatment on quality of date palm (cv. Stamaran)



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## KEYWORDS

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Storage

**Abstract** In this research, fresh harvested date palm (*Phoenix dactylifera* L.) cv. “Stamaran” was treated with hot water rinsing and dried (HWR) at 50 °C (HWR-50), 60 °C (HWR-60) and 70 °C (HWR-70). The effect of these heat treatments on fruit quality was investigated during 6 months at ambient temperature storage (25 °C of temperature and 75% of humidity). Moisture, pH, color, weight loss, Brix and firmness of the samples were studied. Results indicated that during storage the moisture content and color changed significantly. The major change was observed for firmness where a maximum force for puncture test varied from about 3.5 to 2 N forces for all samples after 6 months of storage at 25 °C. Harvesting at Tamr stage followed by treating the fruits with hot water, drying and storing at 25 °C (Especially HWR-70) showed to be a promising method for maintaining date palm fruit storage quality.

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## 1. Introduction

Date palm fruit (*Phoenix dactylifera* L.) is an important agricultural product of Iran and many Arabic countries. Dates are rich in certain nutrients and provide a good source of rapidly available energy due to their high carbohydrate

content (70–80%). Most of the carbohydrates in dates are in the form of fructose, glucose and sucrose, which are easily digested by the human body. The good nutritional value of dates is also based on their dietary fiber content, which makes them suitable for the preparation of fiber-based foods and dietary supplements (Al-Frasi et al., 2005). Date palm cultivars are of three main types according to their fruit moisture content i.e. soft, semi-dry and dry cultivars (Selim et al., 1970). Ismail et al. (2006) reported that chemical and physical characteristics of the fruits influenced their mechanical and rheological properties, which in turn can be indicators of firmness and ultimately of quality. Also, it revealed new and essential information for better understanding of the date fruit that helps to enhance industrialization and propagation of the best date

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varieties that satisfy producers as well as consumers' demands. Stamaran is considered one of the main date cultivars of Iran, particularly in the southern provinces e.g. Khuzestan. Stamaran date is classified as a semi-dry variety and it is the most valuable variety of the dates in Iran.

Postharvest heat treatment offers a pesticide-free method to kill or weaken plant pathogens, control insect infestations and maintain fruit storage quality (Barkai-Golan and Phillips, 1991; Shao et al., 2007). A new technology has been proposed for simultaneously cleaning and disinfecting fruits using hot water rinsing (HWR). Recently, HWR treatments are studied extensively because of their higher temperature and shorter exposure time than traditional hot water immersions or dips. HWR treatments could not only remove the heavy dirt, pesticides and fungal spores on the freshly harvested produce, but could also improve general product appearance and maintain product quality (Fallik, 2004). Because this technology has been designed to be a part of the commercial packing house sorting line and successfully used on the postharvest fresh-keeping treatment of sweet pepper (Fallik et al., 1999) and mango (Prusky et al., 1999), HWR treatments would be desirable for treating freshly harvested produce on a commercial scale (Porat et al., 2000).

The effectiveness of sodium chloride and acetic acid for the initiation/acceleration of the ripening of Dhakki dates has been investigated by Saleem et al., 2005. They treated Pakistani Dhakki date fruits individually and/or in a combined form at different proportions varying from 0.25% to 3.5% and from 0.25% to 2.5% for sodium chloride and acetic acid, respectively. All of the treatments, whether applied as a single treatment or in a combined form, tended to induce ripening by causing changes in the selected quality parameters. The results of the controlled ripening of date fruits were reported to be satisfactory (Saleem et al., 2005).

Kalra and Jawanda harvested date fruits of Khudrawi and Shamran varieties at their hard stage and treated them with NaCl at 0.5–2.0% and acetic acid at 0.5–2% alone and in combination. They packed the dates in wooden boxes lined with paper and stored at room temperature for 18–24 h, after which fruit ripening was assessed. Fruits of Khudrawi and Shamran treated with 2.0% NaCl alone achieved 72% and 75% ripening as determined by weight, respectively (Kalra and Jawanda, 1974).

Shamshiri and Rahemi determined the effect of post harvest treatment on the ripening and quality of Mazafati date fruits using acetic acid (2%), sodium chloride (2%), or a combination of 2% acetic acid with sodium chloride. Either separately or combined sodium chloride and acetic acid significantly increased total soluble solids (TSS), but reduced fruit firmness and moisture content. Acetic acid at 2% had a greater effect on fruit ripening than sodium chloride, but fruits that were treated with sodium chloride were better in appearance (Shamshiri and Rahemi, 1999).

To our knowledge, however, there is a little or no report on the effect of HWR treatments on date palm under different storage durations (particularly color and appearance). Thus, the main aim of this work was to study Stamaran date fruit quality properties at Tamr stage affected by HWR treatments and determine whether HWR treatments are suitable to be used as practical postharvest treatments and commercial implementations for date palm fruit and to improve its appearance.

## 2. Materials and methods

### 2.1. Materials

In the current research project date fruits (variety, Stamaran) were collected from a commercial date farm in Khuzestan (southern Iran) at the Tamr stage in September 2012. Healthy and uniform date fruits were selected and transferred to the Department of Food Science and Technology of Tarbiat Modares University to be kept at 4 °C before other treatments (up to one day). After rinsing (a few seconds) the date with hot water (60 °C), the samples were dried by different temperature (50, 60 and 70 °C) until reaching to the initial moisture. Then, they were picked out and randomly distributed into three batches. The codes of the treatments are given in Table 1. Each sample was then packed in a perforated polystyrene plastic box and incubated for up to 6 months in ambient temperature storage (25 °C of temperature and 75% of humidity). The samples were collected at 0, 0.5, 1, 3, and 6 months of incubation times and further experiments were carried out. Each batch for every time contained 100 fruits.

### 2.2. Methods

Moisture content, pH, Brix, Hunter color parameters ( $L^*$ ,  $a^*$ , and  $b^*$  values) and fruit firmness (texture) were estimated at 0, 0.5, 1, 3 and 6 months at 25 °C storage.

### 2.3. Chemical and physical analysis of date samples

#### 2.3.1. Moisture content and pH

Moisture content and pH were quantitatively determined according to AOAC methods in triplicate (AOAC, 2012).

#### 2.3.2. Weight loss

Thirty fruits of each batch were used for measurement of weight loss. The fruits were weighted and the results were expressed as percentage of weight loss over the initial value (Vicente et al., 2003).

#### 2.3.3. Color and firmness

Ten fruits of each treatment were used to measure both color and firmness. Two readings per fruit were taken on opposite checks of the date palm. Firmness was measured using a Texture Analyzer (Stevens-Lfra, England). The texture of all date samples was evaluated with a cylindrical puncture probe with the diameter of 7 mm at room temperature (about 25 °C). To minimize variations, it was tried to use samples with almost similar thickness. The moving speed of the probe and the

**Table 1** The codes and treatment of four date samples used in this research.

Sample code	Treatment
HWR-50	Rinsing with water 60 °C and drying at 50 °C
HWR-60	Rinsing with water 60 °C and drying at 60 °C
HWR-70	Rinsing with water 60 °C and drying at 70 °C
Control	No treatment

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