

Effect of Steaming on Textural Properties of Date Paste (C.V. Kabkab)

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Abstract—Date paste as an important date products, has found many applications in food industry in recent years. After production color change and solidifying of the date paste and aggravation during maintenance are considered as the major problems facing the date paste processing factories. This research has carried out in order to overcome the solidification of date paste (*Kabkab cultivar*) in a full factorial experiment with three factors of: date paste preparation method (two levels of immersion in hot water or steaming), added oil (sesame and olive oil as a preservative) and three type of packaging (cellophane, nano silicone and multi-layered) in a split plot design with preparation method as the main plot. Textural properties including hardness, Young's modulus, shear modulus, and the penetration work done were measured at 0, 1, 2, 3, 4, 5 and 6 months of storage using a texture analyser. The result confirms the positive effect of steaming for 10 minutes to maintain the softness paste during the test period. Date paste of firmness made from method of steaming and immersion in hot water is 0.02 N and 19 N respectively.

Keywords: *date paste, kabkab, textural properties, steaming, shelf life*

I. INTRODUCTION

Date palm (*Phoenix dactylifera*. L) is the oldest human-planted tree. The fruit is well adapted to arid and semi-arid regions of the world, and between longitude 10⁰ and 39⁰ found. Dates are from ancient times an important food source for human and animal [1].

Palm fruit consists of seeds and a fleshy sheath (between 85% and 90% of fruit weight). Few studies have been conducted on the development new products of flesh. Chemical composition of date indicate that its flesh is an important source of sugar (about 88-81%, mainly fructose, glucose and sucrose), dietary fiber (about 8-5%) and small amounts of protein, fat, ash and polyphenols. So the date provide a good energy source and Has good

nutritional value according to the content of dietary fiber [2].

Process industries manufacture various date products like date-paste, date-syrup, date-dip, date-honey, date-jam, date-vinegar, and so on. Date is generally steamed, destoned, macerated, and converted to a semisolid form known as paste with approximately 20–23% moisture content and a water activity below 0.6 [5]. Date paste has been used as filler and also substitute sugar in many food formulations. Confectionary industries have been utilizing date paste as one of the major ingredients [3, 4 and 5].

Color change and solidifying of the date paste after production are considered major problems facing the date processing factories. Statistical analysis revealed that the storage temperature and moisture content significantly affected the color components, water activity, pH and shelf life. Also, the addition of L-Ascorbic Acid prevent the degradation of color significantly ($p \leq 0.05$). addition of L-Ascorbic Acid to the date paste reduced the pH and rate of changes in mechanical properties significantly [6]. The viscoelastic properties and visual colour degradation kinetics of date paste (*Lulu cultivar*) were investigated at selected temperatures. Dynamic rheological characteristics of date paste were evaluated and viscoelasticity of paste was confirmed. Both elastic and viscous modulus shows slight dependence on frequency. Mechanical spectra indicated a weak gel exist in date paste sample and decreased with temperature. Degradation of colour during thermal processing of date paste followed the first-order reaction kinetics [4].

Date paste is one of the most desirable and widely processed local date products in Sultanate of Oman. The dryness and hardness of date paste was reported by regional ministry staff to be the main problem facing the producers of the product. However, few of them have attempted to overcome this problem by adding water or oil because this leads to a low quality final product. Previous studies have also reported on the changes in mechanical properties of untreated date paste with the passing of time. Al-Abid et al (2007) exposed two omani

date cultivars, namely *Bunarinja* and *Fardh* to steam for 3 different lengths of time (5, 10, or 15 minutes), wrapped in cellophane sheets and stored at room temperature. Moisture, pH, compression force, colour space, and water activity were monitored for 11 weeks. The results confirmed the effectiveness of 10 minutes of steaming to both sustain the softness and help preserve the paste [7]. Invertase enzyme in date is an important enzyme, which controls the reducing sugars and the water content. It seems to affect enzymatic and non-enzymatic reactions responsible for changes in texture, colour and taste of date during ripening and storage time. The maximum invertase activity occurs at the late stages of fruit development and it is found to be different in different cultivars. The difference in invertase activity among the cultivars may reach almost 250-fold higher in soft cultivars than in dry cultivars. The water content in dates is a considerable factor in invertase activity. In fruit with a high invertase activity high moisture content is retained which seems to enable the other existing enzymes related with fruit softening and darkening to act at better conditions [8]. Results of previous studies indicated that there are few information on textural properties and improved date paste production. So this research done in order to overcome the solidification of date paste (*Kabkab cultivar*) using steaming.

I. MATERIALS AND METHODS

This research has carried out in order to overcome the solidification of date paste (*Kabkab cultivar*) in a full factorial experiment with three factors of: date paste preparation method (two levels of immersion in hot water or steaming), added oil (sesame and olive oil as a preservative) and three type of packaging (Cellophane, Nano silicone and Multi-layered) in a split plot design with preparation method as the main plot. Commercial Date of the cultivar, kabkab at the "Tamr stage" (full ripeness) were obtained from an active Kabkab processing plant in "Behbahan" region. Dates washed by immersion in water and then their stones separated manually.

A. date paste preparation

Two methods were used for date paste preparation. at the first method, dates immersed in hot water (95 °C, 10 second) and after add olive and sesame oil, 25 kg per kilogram of dates, were twice crushed with a Toshiba MT-1000A grinder until obtaining a homogeneous paste and were molded using molds with dimensions of 2 × 8 × 8 cm. at the second method after addition oil to dates, twice crushed and after molding were exposed to steaming for 10 minutes using a Hamilton HES-886 steamer.

B. Packaging

Samples of date paste prepared from both methods, were package in three types of package include of nano-silicon, twolayer and cellophane, and were maintained at 25 ° C for 6 months.

C. Measurement of textural properties

Textural properties of date paste as hardness and durability factors were measured during storage by texture analyser with a cylindrical 5 mm diameter probe. Probe speed was 30 mm per minute, Trigger point and penetration depth of the probe were considered 0.1 N and 10 mm, respectively. Hardness, modulus of elasticity, shear modulus, and penetration work data were achieved at time intervals of 0, 1, 2, 3, 4, 5 and 6 months.

D. Statistical analysis

The measured parameters were subjected to analysis of the variance (ANOVA test) by using A statistics program SAS(version), I Type error were consider at probability level $\alpha = 0.05$.

III. RESULTS AND DISCUSSION

ANOVA results of textural properties as a function of the factors studied are shown in Table 1. According to table 1 effects of the preparation method and time and also interaction effect of date paste preparation method and time on all of the textural properties of date paste are significant ($\alpha=0.01$). According to Figures 1 and 2 that show independent effects between preparation method and time, steaming method about all textural properties indicated less value than method of immersion in hot water. Figure 3 shows interaction effects between preparation method and time on Hardness, modulus of elasticity, shear modulus and penetration work of date paste, respectively. Textural properties behavior about method of steaming smoothly increases during maintenance and date paste to remain reasonably soft at the end of 6 months. Textural properties about method of immersion in hot water shows increase behavior at the first month then decrease at the second month and be tangent with steaming chart at the last 2 month. It is possible that the method of immersion in hot water (95° C, 10 seconds), not only to stop the enzyme mechanisms and physicochemical reaction, but has booster effect on date paste softening during first month. At the result of this method the date paste moisture increased and After preparation date paste by breaking down the cell walls and remove the protective shell, provided suitable substrate for enzyme activity. invertase enzyme in date breaks sucrose into glucose and fructose. As regards fructose is most water absorbent among

sugars, remove needed free water of enzymes activity and change condition in favor of the cellulose and

polygalacturonas enzyme activity affecting softening date paste [9].

TABLE 1. ANOVA results of textural properties as a function of the factors studied

Source	Hardness	Modulus of elasticity	Rigidity	Penetration work
Method	59.7544 **	43.1755 **	59.1989 **	38.8405 **
Additive	1.7931 ns	-	-	2.3693 ns
Time	46.9085 **	18.6645 **	22.2898 **	21.5011 **
Packaging	0.0335 ns	3.2229 *	-	1.1305 ns
Method × time	58.9854 **	18.4072 **	21.8138 **	21.618 **
Method × packaging	1.6146 ns	4.7349 *	-	1.9075 ns
Packaging × additive	2.4555 ns	-	-	-
Packaging × time	-	-	-	1.8755 ns

ns. Nonsignificant, *. Significant at probability level 5% and **. Significant at probability level 1%

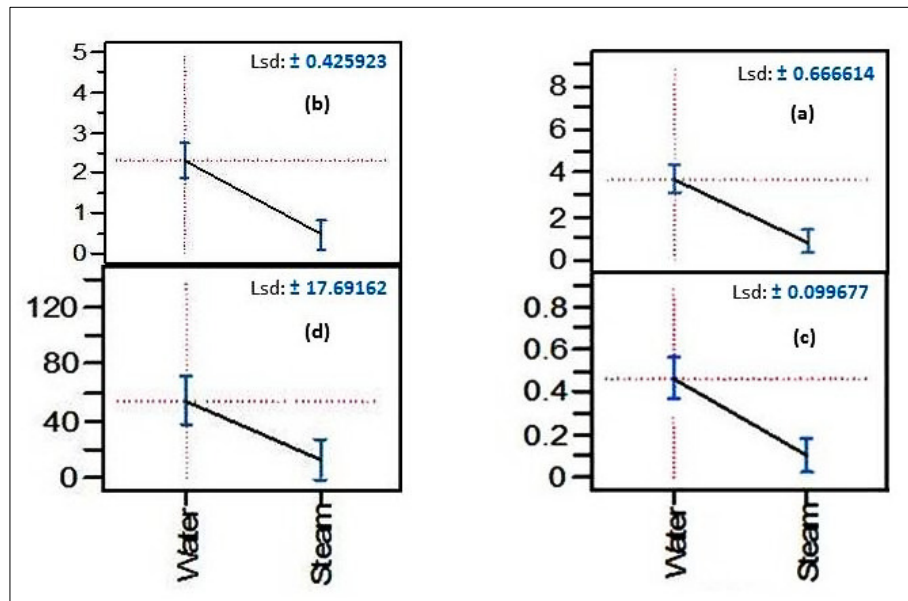


Figure 1. Effect of method on textural properties of date paste. a) Hardness, b) Elastic modulus, c) Rigidity, d) Penetration work

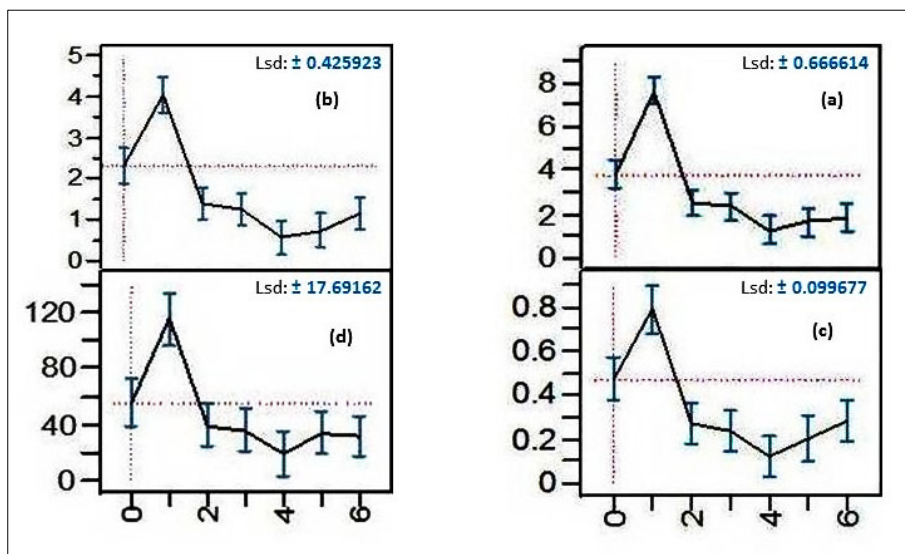


Figure 2. Effect of time on textural properties of date paste. a) Hardness, b) Elastic modulus, c) Rigidity, d) Penetration work

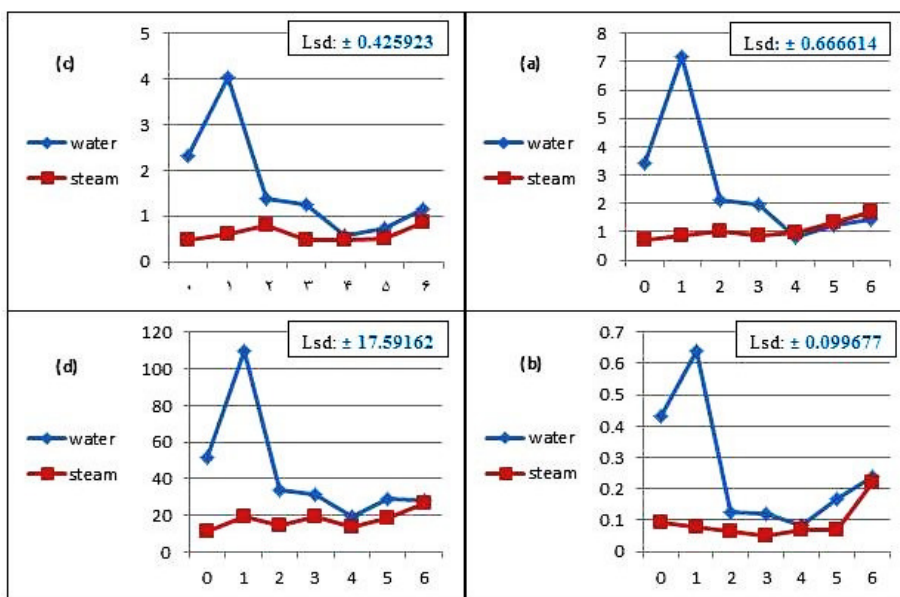


Figure 3. Interaction effects between preparation methods and time on textural properties

It is possible steaming date paste to stop or slow down the physicochemical and enzymatic reactions of dates, well able to maintain softness of date paste during storage. So despite to tangent charts at the last two months, there are noticeable difference between texture date paste under effect both preparation methods, as texture date paste

prepared with immerse in hot water method is non-homogeneous and fibery than homogeneous texture from steaming method. So steaming for 10 minutes can maintain date paste from firming effects. Zare et al, 2002 reported role of enzyme invertase in causing sucrose inversion in dates and also importance of

sucrose hydrolysis on textural quality of date. The degree of this inversion as a function of invertase activity depends on the moisture content and temperature of incubation. Dates undergo certain chemical changes during storage and slowly deteriorate. More information on the chemical reactions that cause deterioration of dates would aid in the development of criteria to evaluate the quality and methods to preserve dates [8]. Al-Abid et al. 2007 indicated the effectiveness of 10 minutes of steaming to both sustain the softness and help preserve the paste [7]. Mostaan et al, 2012 reported Same result about the effectiveness of 10 minutes of steaming to maintain the softness "sayer" date paste [10]. Ahmed et al, 2005 indicated that both elastic and viscous modulus in date paste "Lulu cultivar" have dependence At selected temperature range (70–120°C) [4].

Figure 4 indicated Interaction between date paste preparation method and packing on the modulus of elasticity. dates paste modulus of elasticity in three package about method of immersion in hot water is lower

than steaming method. Therefore, suggested that selection of appropriate packaging film permeability and the ability to cover up samples is effective on maintaining softness and quality product. Salari et al, 2008 reported that Time and temperature and type of packaging film have noticeable effects on date quality[11].

IV. CONCLUSION

The results confirmed positive effect of steaming for 10 minutes on date paste softening during storage at 25 ° C. The positive effect is due to thermal sterilizing in addition to enzyme inactivation. The quality of the product is not altered as steam is a natural treatment and no preservatives are added. Steaming for 10 minutes is recommended to soften the date paste. Results also showed that silicon nano-packaging with low thickness and low permeability is good cover for date paste during time storage.

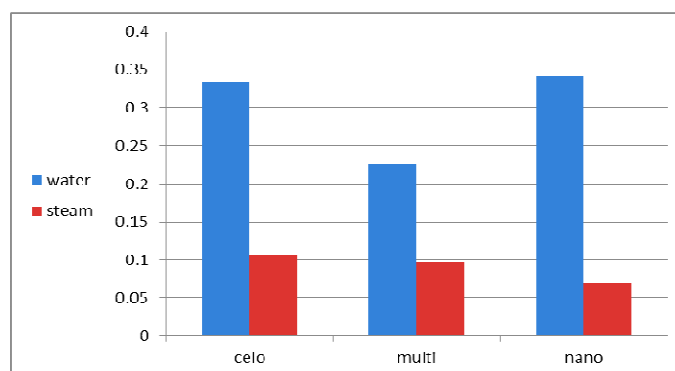


Figure 4. Interaction between date paste preparation method and packing on the modulus of elasticity

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