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The Impact of Conservation on the Concentration of Quercetin and Kampferol in Khalas Dates

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ABSTRACT

A study was conducted to compare the effect of conservation on the concentration of flavonoids such kampferol and Quercetin in Khalas dates using refrigeration with a temperature of +6°C and at room temperature 25°C. After two days of conservation, it was found that the concentration of kampferol was 0.024 mg/100 g which was identical to the concentration of kampferol (0.024 mg/100 g) at +25°C. But in the case of refrigeration, the concentration of Kampferol was 0.023 mg/100 g at +6°C whereas the concentration of Quercetin was 0.027 mg/100 g dates. At 3-weeks of conservation, the mean concentration of Quercetin was 0.087 mg/100 g in Khalas dates while that of kampferol was 0.067 at +6°C. But at +25°C conservation temperature the concentration of kampferol reached to 0.45 mg/100 g as compared to Quercetin concentration of 0.045 mg/100 g. The research findings showed that date conservation at +6°C increased the concentration of flavonoids such as Kampferol and Quercetin. The study showed that date storage under chilled conditions can maintain higher levels of different flavonoids.

Key words: Conservation, khalas dates, chilled storage conditions, flavonoids, kampferol, Quercetin

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is the major fruit tree of Kingdom of Saudi Arabia. Due to its ability to tolerate adverse environmental conditions has made the arid climate of Saudi Arabia quite unique for its cultivation. The estimated annual production of dates in Saudi Arabia is 986000 tons occupying an area of 140000 hectares (FAO, 2008).

Dates are an ideal high-energy food rich in carbohydrates including dietary fiber and minerals such as calcium, iron, magnesium, phosphorus, potassium and zinc. Recent studies indicated that the aqueous extracts of dates have potent antioxidant and anti-mutagenic activity (Mansouri *et al*., 2005). The antioxidant activity is attributed to the wide range of phenolic compounds present in dates including p-coumaric, ferulic and sinapic acids, flavonoids and procyanidins (Mansouri *et al*., 2005; Gu *et al*., 2003; Vayalil, 2002).

Date fruits are an excellent source of phenolics and therefore possess an extremely high antioxidant capacity. Date fruits have been reported to contain various phenolics, such as protocaechuic, p. hydroxy benzoic, vanillic, syringic, caffeic, coumaric, ferulic, hydroxy benzoic and hydroxyl cinnamic acids (Al-Farsi *et al*., 2005) which contribute significantly towards total antioxidant activity. Also, Mohamed and Al-Okbi (2005) evaluated *in vitro* the antioxidant activity of different extracts of date fruit as functional foods. The total phenolic and flavonoid contents of

eight selected date fruits from Iran were reported in a previous study (Biglari *et al*., 2008). It was observed that phenolic compounds and flavonoids gave rise to antioxidant activities in dates (Mansouri *et al*., 2005).

Flavonoids are a widely distributed group of polyphenolic compounds with health-related properties which are based in their antioxidant activity. These properties have been found to anticancer, antiviral, anti-inflammatory activities, effects on capillary fragility and an ability to inhibit human platelet aggregation (Benavente-Garcia *et al*., 1997). It is generally assumed that the active dietary constituents contributing to these protective effects are the antioxidant nutrients. Although more recent work has highlighted the additional role of the polyphenolic components of the higher plants (Hertog *et al*., 1993) which may act as antioxidants or agents of other mechanisms that contribute to their anticarcinogenic or cardioprotective actions. These compounds have applications in food stabilization due to their ability to protect against peroxidation of oxygen sensitive foods. Flavonoids are a widely distributed group of polyphenolic compounds characterized by a common benzo-y-pyrone structure, which have been reported to act as antioxidants in various biological systems (Morel *et al*., 1993; Salah *et al*., 1995; Wang and Zheng, 1992). Flavonoids present in wide varieties of edible plants, especially in Citrus species.

Four types of flavonoids (flavanones, flavones, flavonols and anthocyanins, the last only in blood oranges) occur in Citrus (Horowitz and Gentili, 1977) and more than 60 individual flavonoids have been identified. Yu *et al*. (2005) tested various flavonoid compounds which included two limonoids, limonin (Lim) and limonin 17-β-d-glucopyranoside (LG); eight flavonoids, apigenin (Api), scutellarein (Scu), kaempferol (Kae), rutin trihydrate (Rut), neohesperidin (Neh), neoeriocitrin (Nee), naringenin (Ngn) and naringin (Ng) and a coumarin (bergapten). Manthey *et al*. (2001) stated that the Citrus flavonoids encompass a diverse set of structures, including numerous flavanone and flavone O- and C-glycosides and methoxylated flavones. Each of these groups of compounds exhibits a number of *in vitro* and *in vivo* anti-inflammatory and anticancer actions.

The information on the effect of storage conditions on the flavonoids especially the quercetin and kampferol in dates is limited under local conditions. The main objective of this research was to determine the effect of conservation on the concentration of quercetin and kampferol in Khalas dates under chilled and normal storage conditions in Al-Ahsa, Saudi Arabia.

MATERIALS AND METHODS

Fruit samples of Khalas date fruits were collected from Al-Ahsa region, Saudi Arabia and frozen immediately for determinations of flavonoids.

Test of Tannins: About 5 g of the powdered sample was extracted with 50% ethanol and filtered. Upon the addition of ferric chloride reagent, (10% ferric chloride ($Fe\ Cl_3$) solution in ethanol), to the filtrate, a green color formed which changed to a blush black color or precipitate, indicating the presence of tannins (Shellard, 1957).

Test for flavonoids: Ten grams of the date's samples were macerated in 50 ml of 1% hydrochloric acid overnight, and then filtered and the filtrate was subjected to the following tests:

- About 10 ml of the filtrate was rendered alkaline with NaOH; formation of a yellow color, indicating the probable presence of flavonoids.

- **Shinoda test:** About 5 ml of the filtrate was mixed with 1 ml HCl and magnesium metal was added. A red color formation indicates the presence of flavanones and/or flavonols (Geissman, 1961).

- **Concentration of flavonoids:** The determination of flavonoids was performed according to the colorimetric assay of Kim *et al.* (2003). Distilled water (4 ml) was added to 1 ml of extract. Then, 5% sodium nitrite solution (0.3 ml) was added, followed by 10% aluminum chloride solution (0.3 ml). Test tubes were incubated at ambient temperature for 5 min and then 2 ml of 1 M sodium hydroxide were added to the mixture. Immediately, the volume of reaction mixture was made to 10 ml with distilled water. The mixture was thoroughly vortexed and the absorbance of the pink colour developed was determined at 510 nm. A calibration curve was prepared with querscetin and Kampferol and the results were expressed as mg equivalents/100 g sample.

RESULTS AND DISCUSSION

Table 1 shows the effect of storage temperature on the concentration of quercetin. Initially, at the start of the experiment, the average concentration of quercetin was 0.021 mg/100 g at +6°C. At +25°C the concentration was 0.023 mg/100 g. The test results showed the mean concentration of quercetin as 0.023 with +6°C whereas it was 0.27 mg/100 g at +25°C. After 3 weeks, the mean concentration of Quercetin was 0.087 with increasing temperature from +6°C to +25°C. Overall the mean concentration came to 0.06 mg/100 g which means that with more storage time, the concentration of Quercetin showed increasing trend when stored at +6°C or there was a little

Table 1: Effect of the storage process on the concentration of Quercetin on Khalas dates at different time periods

	Quercetin			
	At cool refer. +6 conc. mg/100 g dates		At room temp. +25 conc. mg/100 g dates	
Time	Samples	Mean	Samples	Mean
Control	0.020	0.021	0.022	0.023
	0.021		0.023	
	0.022		0.023	
After 2 day	0.022	0.023	0.026	0.027
	0.023		0.027	
	0.024		0.028	
After 5 day	0.024	0.024333	0.040	0.042
	0.025		0.042	
	0.024		0.043	
After 1 week	0.028	0.03	0.052	0.053
	0.030		0.055	
	0.032		0.052	
After 2 week	0.062	0.063333	0.056	0.055
	0.063		0.056	
	0.065		0.054	
After 3 week	0.082	0.087667	0.060	0.060
	0.089		0.059	
	0.092		0.061	

Table 2: Effect of the storage process on the concentration of Kampferol in Khalas dates at different time periods

	Kampferol			
	At cool refer.+6 conc. mg/100 g dates		At room temp. +25 conc. mg/100 g dates	
Time	Conc.	Mean	Conc.	Mean
Control	0.010	0.011	0.010	0.011
	0.011		0.010	
	0.012		0.012	
After 2 day	0.024	0.024	0.023	0.024
	0.0242		0.024	
	0.025		0.025	
After 5 day	0.032	0.033	0.026	0.028
	0.033		0.028	
	0.033		0.029	
After 1 week	0.045	0.051	0.031	0.032
	0.056		0.032	
	0.052		0.033	
After 2 week	0.054	0.055	0.040	0.041
	0.056		0.041	
	0.056		0.042	
After 3 week	0.066	0.067	0.045	0.045
	0.067		0.046	
	0.068		0.045	

increase at the storage temperature of +25°C. Overall, it was observed that the higher concentration of Quercetin could be maintained at temperature of +6°C than at + 25°C.

Table 2 presents the effect of storage temperature on the concentration of kampferol. Initially, at the start of the experiment, the average concentration of kampferol was 0.011 mg/100 g at +6°C. At +25°C the concentration was 0.11 mg/100 g. The test results showed the mean concentration of kampferol as 0.033 with +6°C whereas it was 0.28 mg/100 g at +25°C. After 3-weeks, the mean concentration of kampferol was 0.067 with increasing temperature from +6°C to +25°C. Overall the mean concentration came to 0.045 mg/100 g which means that with more storage time at +6°C, the concentration of kampferol showed increasing trend while there was a little increase at the storage temperature of +25°C. Overall, it was observed that the higher concentration of kampferol could be maintained at temperature of +6°C than at +25°C.

It was observed that the concentrating of flavonoids showed increasing trend under chilled temperature storage conditions. The study results agree with many researchers who indicated a change in the phenolic compounds profile of different fruits and vegetables under chilled storage conditions (Kevers *et al*., 2007; Leja *et al*., 2008; Tavarini *et al*., 2008). The results of this study were supported by other investigators who stated that the preliminary photochemical screening of date palm inflorescence (Zaghloul cv.) showed the presence of high concentrations of flavonoids and carbohydrates (Abo-El-Soaud, 2003).

CONCLUSIONS

The concentration of flavonoids such as Quercetin and kampferol showed increasing trend when stored at +6°C or there was a little increase at the storage temperature of +25°C. Overall, it was

observed that the higher concentration of Quercetin and kampferol could be maintained at temperature of +6°C than at + 25°C.

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