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ORIGINAL ARTICLE

Quantification of water soluble vitamins in six date palm (*Phoenix dactylifera* L.) cultivar's fruits growing in Dubai, United Arab Emirates, through high performance liquid chromatography

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Abstract In present investigation, a comparative analysis of water soluble vitamins viz., B1 (thiamine HCl), B2 (riboflavin), B3 (nicotinamide), B5 (pantothenic acid), B6 (pyridoxine HCl), B9 (folic acid), B12 (cyanocobalamin) was carried out in fruits (immature, semimature and mature) of six date palm (*Phoenix dactylifera* L.) cultivars (''Barhee'', ''Khalasah'', ''Muzati'', ''Shishi'', ''Zart'', ''Zardai'') growing in United Arab Emirates (UAE) by high performance liquid chromatograph (HPLC). The fruits were collected at three developing stages (immature, semimature and mature). Quantitative analysis of water soluble vitamins yield showed a significant variation within the different cultivars and the developing stages of date palm fruit. Vitamin B1, B3, B5, B6 were maximum (μg/100 g f.w.) in ''Shishi'', ''Zardai'', ''Shishi'' and ''Muzati'' at their matured stage, however, vitamin B2, B9, B12 were detected in immature fruit of ''Khalasah'', ''Khalasah'' and ''Shishi'' cultivars. The vitamin production in fruits of different date palm cultivars was, therefore, developing

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stage specific and cultivar dependent. The present study showed that the date palm fruit could be used for human consumption with value addition of water soluble vitamins at their specific developmental stages.

1. Introduction

The date palm (*Phoenix dactilyfera* L.), species has 19 known genetic relatives. The genus *Phoenix* belongs to the family Arecaceae. The fruit is a Berry type (known also as Drupe) with a single seed in each. Date palm is one of the most important cash crops; it is especially grown in Arab region and the area bordering the Mediterranean coast. It has been cultivated since the prehistoric time in most of the Gulf, Asian and African countries. More than 2000 date palm cultivars enlisted through the world, but few of them have been screened for their large agronomic performance and fruit quality (Al-Hooti et al., 1997). Due to the nutritional value of the fruit; researchers have focused their attention on characterization of the physico-chemical analysis of the important date palm cultivars (Al-Shahib and Marshall, 2002; Mrabet et al., 2008). Increase in date fruit production will, therefore, play a significant role worldwide in the improvement of nutritional status of people, with special reference to calories and important minerals (Ahmed et al., 1995). It is usually taken raw or with milk, which makes it highly nutritious in most respects. Taking it with curdled milk is also common. The seeds of the fruit, roasted and ground into powder makes a beverage like coffee, called 'date coffee'. The date palm yields a sweet juice of high food value. It can be taken fresh with great advantage or made into a tasty country sugar. The juice can also be allowed to ferment and made into alcohol. It provides natural sugar in the form of glucose and fructose. This sugar is ready for immediate absorption and is, therefore, infinitely superior to canesugar. Dates are rich in sugar ranging from 65% to 80% on dry weight basis mostly of inverted form (glucose and fructose). Fresh varieties have a higher content of inverted sugars; semi dried varieties contain equal amounts of inverted and sucrose, while dried varieties contain higher sucrose. Water content is between 7% (dried) and 79% (fresh) depending on the cultivars (Myhara et al., 1999; Al-Farsi et al., 2005). Therefore, the moisture, total nitrogen, fat, fiber, ash, tannins, vitamin C, β-carotene and ten nutritionally important minerals were highest in the early stage of development and decreased during maturation. Date fruit, being exceptionally rich in potassium and extremely low in sodium (Ahmed et al., 1995).

Dates are valuable as medicine for their tonic effect. Being easily digested, they are very useful for supplying energy and repairing waste. Milk in which fresh and cleaned dates have been boiled proved very nourishing and proved as a restorative drink for children and adults alike, especially during convalescence. A number of studies have been carried out to characterize its chemical composition particularly minerals, polysaccharides, carbohydrates in fresh date fruit (Fayadah and Al Showiman, 1990; Al-Hooti et al., 1997;Al-Shahib and Marshall, 2002). It has been reported that the vitamins play a potent role to reduce the damage carried out by the free radicals and check degenerative disease (Jacab and Sotoudeh, 2002). In addition, vitamin supplements showed the ergogenic and performance enhancing effects (Clarkson, 1993; Zhao et al., 2004). Thus, chemical and physical characterization has been carried out previously by many workers (Al-Juburi et al., 1994; Al-Hooti et al., 1997; Attalla and Harraz, 1996; Mrabet et al., 2008), but there is a distinct lack of information on water soluble vitamins during the ripening stages of date palm fruit. Therefore, the present investigation was undertaken to determine the presence of water-soluble vitamins (Fig. 1) in fruits of selected date palm cultivars at their developmental stages (immature, semimature and mature) growing in Dubai, United Arab Emirates.

2. Experimental

2.1. Experimental material

The fruits of six different date palm (*Phoenix dactylifera* L.) cultivars ("Barhee", "Khalasah", "Muzati", "Shishi", "Zart", "Zardai") were collected at their developing stages (immature, semimature and mature) from Al-Muhasinah-1, Dubai, United Arab Emirates.

2.2. Reagents and solvents

The reagents and chemicals were used in the present study were of analytical grade viz., HPLC methanol (Merck), acetonitrile HPLC (Merck), glacial acetic acid (BDH), triethylamine (RDH), orthophosphoric acid (BDH), pic6 (hexane sulfonic acid), sodium salt (Merck). The Millipore direct *q* system based distilled and deionized water was used for the preparation of reagents and stock solution.

2.3. Standard preparation

The standard stock solution of the water soluble vitamins was prepared as follows: (a) vitamin B1 (thiamine HCl) was prepared by dissolving 26.7 mg of thiamine hydrochloride in 25 ml of double distilled water; (b) vitamin B2 (riboflavin) was prepared by dissolving 6.9 mg of riboflavin in 100 ml of extraction solution (the extraction solution has limit to dissolve 7 mg of riboflavin); (c) vitamin B3 (nicotinamide) was prepared by dissolving 41.5 mg of nicotinamide in 25 ml of double distilled water; (d) vitamin B5 (calcium salt of pantothenic acid) was prepared by dissolving 21.4 mg of calcium *d*-pantothenate in 25 ml of double distilled water; (e) vitamin B6 (pyridoxine HCl) was prepared by dissolving 20.8 mg of pyridoxine hydrochloride in 25 ml of double distilled water; (f) vitamin B9 (folic acid) was prepared by dissolving 11.2 mg of folic acid in 25 ml of double distilled water; (g) vitamin B12 (cyanocobalamin) was prepared by dissolving 19.8 mg of cyanocobalamin in 25 mg of double distilled water.

2.4. Working standard

The working standards were prepared as follows: (i) B1, 1.068 mg/ml and 562 μl was taken in 10 ml volumetric flask,