

Preliminary analysis and potential uses of date pits in foods

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Abstract

Date pits were examined for extractable high value-added components for including in functional foods. The objectives of this research were to conduct preliminary analysis of the pits from three leading varieties in UAE and to identify potential uses in foods. Date pits were odourless and had light to dark brown colour and a bland taste with slight bitterness. They contained 7.1–10.3% moisture, 5.0–6.3% protein; 9.9–13.5% fat; 46–51% acid detergent fibre; 65–69% neutral detergent fibre; and 1.0–1.8% ash. More than half of the pit protein could not be extracted consecutively with NaCl, ethanol and acetic acid. Pits had a substantial amount of oil that needed to be characterized for constituent components, biological activities and stability. Pits contained large quantities of fibre and, possibly, resistant starch that may have potential health benefits. Further research is needed to characterize isolated components and search for bioactive constituents with antimicrobial, antioxidant and other health-promoting activities. Published by Elsevier Science Ltd.

Keywords: Date palm pits; Analysis; Potential food use; Dietary fibre; Functional foods

1. Introduction

Date palm (*Phoenix dactylifera*) is a principal fruit that is grown in many regions of the world, resulting in a surplus production of dates. Date seeds (pits) constitute approximately 10% of the fruit (Almana & Mahmoud, 1994). In the United States, date pits have been a problem to the date industry as a waste stream. Pulverized ground date pits are being used on a small scale, on dirt roads as a type of road base gravel. However, finding a way to make a profit on the pits would benefit date farmers substantially. Occasionally, in the Middle East, date pits are used in animal feed. Vandepopuliere, Al-Yousef, and Lyons (1995) incorporated date pits in broiler starting diets at levels ranging from 5 to 27%. Diets, containing date pits, supported broiler weights and resulted in feed conversions comparable to, or better than, the control diet. Several investigations on the effects of pits in animal diets suggest the presence of substantial amounts of tannins, resistant starch (Hadarmi, 1999) and natural anabolic agents (Elgasim, Al-Yousef, & Humeida, 1995). Almana and Mahmaud

(1994) evaluated date pits as an alternative source of dietary fibre in comparison with wheat bran, and suggested that they may provide a valuable contribution to dietary fibre intakes. Therefore, date pits were examined because they may have an extractable high value-added components for including in functional foods. The objectives of this research were: (1) to perform the chemical analysis of the pits from three leading varieties in UAE; (2) to initially characterize the major components of these pits, particularly proteins, fibre, and oil.

2. Methodology

Date pits were milled in a heavy-duty grinder to pass 1.2-mm screens. Moisture, crude fat, % free fatty acids (oleic), protein, ash, and acid and neutral detergent fibres were determined using standard analytical procedures # 934.01, 960.39, 940.28, 988.05, 942.05, 973.18 and 962.09, respectively (AOAC, 1990). The odour, colour, and taste of the date pits from the three different varieties were examined by an expert panel of five scientists. The Osborn solubility fractionation of protein was carried out by consecutive extraction of hexane-defatted pits using 2% NaCl, 70% ethanol, and 0.1 M

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acetic acid, according to the method of Chen and Bushuk (1970). Residual protein that these consecutive extractions could not extract was solubilized in 0.1 M sodium hydroxide.

3. Results and discussion

3.1. Sensory characteristic of date pits

Date pits from three different varieties were odourless and had light to dark brown colour and a bland taste with slight bitterness.

These sensory characteristics of the pits could facilitate their use in human diet. Recently, Alman and Mahmoud (1994) conducted a sensory evaluation of flat bread made by incorporating date pits at 0, 5, 10 and 15% replacement levels, in comparison to wheat bran. Breads containing 10% coarsely milled fractions were better or similar to the corresponding wheat bran control in sensory evaluation. The fine-milled pit fraction caused a deterioration in bread colour, flavour, odour, chewing, uniformity and overall acceptability.

3.2. Chemical analysis of date pits

Date pits from three different varieties contained 7.1–10.3% moisture, 5.0–6.3% protein; 9.9–13.5% fat; 65–69% neutral detergent fibre; and 1.0–1.8% ash (Table 1). Accordingly, total carbohydrate content of date pits ranged from 71.9 to 73.4% for the three varieties of date

Table 1
Chemical analysis of date pits from three leading varieties in UAE

Analysis	% Component ^a		
	Fard	Khalas	Lulu
Moisture	10.3b	7.1a	9.9b
Crude fat	9.9a	13.2b	10.5a
Crude protein	5.7b	6.0b	5.2a
Ash	1.4b	1.8c	1.0a
Acid detergent fibre	45.6a	50.6b	49.3b
Neutral detergent fibre	67.5ab	64.5a	68.8b

^a Means within a row with no common letter differ significantly ($P < 0.05$).

Table 2
Varietal difference in solubility fractions of date pit proteins

Variety	% Soluble protein ^a				
	Albumin + Globulin	Prolamine	Glutelin	Total soluble protein	Residue protein (NaOH-Soluble)
Fard	24b	16a	7	46c	54b
Khalas	23b	29b	6	58b	42a
Lulu	19a	16a	5	40a	60c

^a Means within a column with no common letter differ significantly ($P < 0.05$).

palm trees. Attalla and Harraz (1996) investigated the chemical composition, including mineral contents, of the pits of 11 date palm cultivars grown in the Qassim region of Saudi Arabia. Date pits contained 57.7–68.9% total carbohydrates, 3.8–5.8% total sugars, 5.1–7.5% total protein, and 8.7–12.3% crude fat. Date pits from the three varieties contained substantial amounts of oil that need to be characterized. Due to the high oil content, conditioning and milling procedures must be changed to avoid rancidity.

3.3. Protein solubility fractionation

About 22, 20, 6 and 53% of the total protein of pits were soluble in salt solution, ethanol, acetic acid, and 0.1 M NaOH, respectively (Table 2). Cereal proteins are often classified by their solubilities in water, salt, alcohol solutions and acids (Chen & Bushuk, 1970). The soluble fractions are termed albumin, globulin, prolamin and glutelin, respectively. This solubility fractionation, known as Osborn classification, was crude because of the impurity of the resulting fractions. However, it demonstrated that large portions of protein in date pits cannot be solubilized by such mild solvents. These insoluble fractions are likely to be composed of high molecular weight polypeptides that are highly aggregated and/or cross-linked by disulfide bridges. Therefore, date pit proteins need to be investigated further to explain their poor solubility and to recover them for potential food use.

Since the protein content in date pits is small and the proteins may not be very digestible, the carbohydrates and lipids may be of greater interest. However date pits may contain amylase or protease inhibitors of possible significant value in functional foods.

3.4. Functional foods

Functional food components are health-promoting, nutritious materials from plant and microbial sources (Pszczola, 1998). They are components that have antimicrobial, anticarcinogenic and other health-promoting activities, such as dietary fibre, vitamins, essential minerals, phytic acid, α -amylase inhibitors and tannins. For instance, phytic acid plays a major role in the

treatment of cancer, hypercholesterolemia, hypercalcuria and kidney stones (Plaami, 1997). Work done recently has indicated that specific inositol polyphosphates have different functional potentials. Siren, Linne, and Persson (1991) outlined potential pharmacological applications for D-myoinositol-1,2,6-trisphosphate, including anti-inflammatory effects, reduction in secondary complications of diabetes, interference with the vasoconstricting agent neuropeptide Y and, thus, reduction of hypertension. Date pits from the three varieties contained very little ash, which may indicate that the phytic acid concentration in date seeds is unusually small, i.e., in comparison to cereal grains and oil seeds. This conclusion is supported by the report of Attalla and Harraz (1996) who found that date pits of 11 cultivars grown in the Qassim region contained small amounts of phosphorus (0.19–0.26%).

Pits contained a large quantity of fibre that may have health benefits. The difference between the quantities of neutral detergent fibre and acid detergent fibre gives the hemicellulose content of the pit sample. It should be noted, however, that the acid detergent fibre is very high, which may indicate the presence of substantial amounts of lignin and perhaps resistant starch in date pits. Furthermore, plant fibres can exhibit unique qualities, such as antioxidant capacity, inherent susceptibility to fermentation to release ferulic acid and glucose retardation indices. Due to their importance in developing functional foods from date pits, the carbohydrates should be characterized further, especially for the presence and quantities of resistant starches. Thorough investigation of these fibres, as well as other interesting and associated components in date pits, will determine their potential uses as functional foods. Date pits can be a source of dietary fibre without any negative impact on sensory quality of end-products if the pits are properly milled (Almana & Mahmoud, 1994). Other functional components that may be present in pits are selenium, which can be used as antioxidant (thus anticarcinogenic) in human therapeutics (Pszczola, 1998). Al-Showiman, Al-Tamrah, and BaOsman (1994) determined the selenium content in dates of some cultivars grown in Saudi Arabia. Selenium levels were found to be in the range 1.48–2.96 µg/g in the 10 varieties they studied, which were grown in different locations. Thus, further research is needed to characterize isolated components and to search for bioactive constituents with antimicrobial, antioxidant and other health promoting activities.

4. Conclusions

Pits of date palm could be an excellent source of functional foods components with the exclusion of phytic acid. Analysis of date pits from three leading varieties in UAE suggested that date pits can be used in foods as an inexpensive source of dietary fibre and other functional components, e.g. resistant starch.

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