Journal of Medicinal Plants and By-products

Original Article

Evaluation of Oil Percentage, Content of Fatty Acids and Mineral Elements in Seeds of some Date Cultivars

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Article History: Received: 04 June 2023/Accepted in revised form: 17 July 2023

ABSTRACT

Fruit and seed of date (*Phoenix dactylifera* L.) have primary and special metabolites which result in therapeutic effects in preventing chronic diseases such as diabetes, blood pressure, liver diseases and cancer. Date seeds have fatty acids and can be used in food, cosmetic health and pharmaceutical industries. Considering the effect of the cultivar on the type and contents of biochemical compounds, seeds of 7 date cultivars ('Ashrasi', 'Barhi', 'Bream', 'Khastawi', 'Khyara', 'Mekawi' and 'Zahdi') originated from Iraq, were investigated in terms of the amount and type of fatty acids and mineral nutrients. The seed percentage was different from 4% in 'Barhi' to 6.3% in 'Khyara'. The type and amount of saturated and unsaturated fatty acids were affected by the cultivar. The highest amount of saturated fatty acids, capric acid (0.34%) and lauric acid (26.06%), was observed in 'Mekawi' and the highest caprylic acid (0.35%) content was observed in 'Barhi'. The highest content of myristic acid (12.60%) and margaric acid (0.28%) was observed in 'Khastawi' and the highest content of palmitic acid (11.99%) and stearic acid (3.76%) was observed in 'Zahdi'. The type of cultivar had no effect on the oleic acid content, while the content of linoleic acid in 'Khastawi' was significantly higher than 'Zahdi'. The content of mineral elements was also affected by the type of cultivar. The highest phosphorus content is in 'Khyara' (0.35%) and 'Bream' (0.32%), the highest amount of potassium is in 'Mekawi' (0.44%) and 'Khastawi' (0.43), the highest calcium content was observed in 'Khastawi' (403 mg/kg) and the highest content of iron was observed in 'Ashrasi' (21.4 mg/kg) cultivar.

Keyword: Mineral Nutrients, Oil Content, Saturated Fatty Acids, Unsaturated Fatty Acids.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is a plant of the Arecaceae family and is widely cultivated in tropical and subtropical regions, especially in the Middle East and North Africa [1]. The gross production value of date fruit has been increasing significantly since the 20th century, reaching more than 14 billion $ in 2020 [2]. Date seed is a byproduct of date fruit production and is usually discarded as waste or used as animal feed [1]; while it consisted of 10 to 15% of the fruit weight and contains 5 to 13% oil [3]. Extensive studies have been conducted on evaluating the medicinal activities of date seeds in terms of antioxidant, anti-inflammatory, anti-diabetic, antibacterial, antiviral and anti-cancer effects [4,5]. Date seeds have represented a high potential as a preventive and therapeutic agent against several chronic diseases [6]. The therapeutic properties of date seeds are due to the presence of primary and special metabolites such as carbohydrates [7], protein [8], fiber [7], vitamins [5], phenolic compounds [9], mineral nutrients [7] and fatty acids [10]. Phenolic compounds such as caffeic acid, chlorogenic acid, pycoumaric acid, ferulic acid, gallic acid and vanillic acid and the presence of fatty acids give date seeds valuable medicinal properties [9, 11]. Saturated fatty acids such as caprylic, capric, lauric, myristic, palmitic, margaric, stearic, arachidic, behenic acid and unsaturated fatty acids such as oleic, linoleic and linolenic acid are of the most important metabolites of date seeds [3]. The presence of such valuable compounds in date seeds shows the value and importance of research on profiling and quantifying compounds for use in food, cosmetic health and pharmaceutical industries [12]. Attia *et al*. (2021) [13] recognized the importance of date seed oil as a natural source of medium-chain fatty acids that increase the growth and immunity level of the body. The date palm consists of separate genetic clones that create thousands of varieties. The genetic resources of dates which include modern cultivars, indigenous breeds, obsolete cultivars, and wild species are considered to be one of the most important components of biodiversity in natural habitats. Cultivated palms are closely related to wild palms, which are distributed in a wide desert belt throughout the Middle East and North Africa [14]. The

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genetic diversity of the species has been formed and drastically changed by humans, natural selection and clonal reproduction of germplasm. The combination of sexual and vegetative reproduction systems has affected the genetic structure of populations and may have led to the accumulation of domesticated traits in date palms [15]. Studies have shown that date seed characteristics are different based on genetic and environmental conditions [16]. Nehdi *et al*. (2018) [3] studied 6 varieties of dates grown in Saudi Arabia ('Barhi', 'Kholas', 'Manifi', 'Raziz', 'Solaj' and 'Sukhari') and showed that the average yield of seed oil was 7% and oleic acid, the predominant fatty acid of the oil is in all cultivars, but the content and profile of fatty acids in different cultivars was different. In another experiment, the contents of oleic acid, lauric acid, myristic acid, palmitic acid and linoleic acid in 'Degla-Baïdha' and 'Tafezouine' cultivars 46.51, 22.1, 10.7, 9.6 and 6.9% and 39.15, 28.5, 11.4, 8.7 and 6.1%, respectively [10].

Having a proper diet can compensate the body's need for mineral nutrients. A significant content of mineral nutrients was detected in date seeds. Twelve cultivars of dates grown in the UAE were investigated and the results showed that the type and content of mineral elements such as zinc, copper, manganese, iron, sodium, potassium and calcium are different in different cultivars [35].

On the other hand, a comparison was made between Bahraini and United Arab Emirates date cultivars in terms of the content of mineral elements, and the results showed that Bahraini cultivars had more sodium and potassium, and United Arab Emirates cultivars had more calcium, magnesium, and zinc [17]. Also, investigating the mineral elements of the seeds of two Iranian date varieties ('Kabkab' and 'Mardasang') showed that there is 'Kabkab' had the highest potassium content (300 mg/100 g) and 'Mardasang' had the highest iron content (7.6 mg/100 g) [18].

Considering the wide differences that have been reported in the oil content, fatty acid composition of oil and mineral nutrients in date seeds, this study was conducted with the aim of evaluating the effect of genotype on oil content, amount and type of saturated and unsaturated fatty acids and mineral elements in date seeds.

MATERIAL AND METHODS

Sample Collection and Preparation

This research was conducted on 7 date cultivars 'Mekawi', 'Khastawi', 'Khyara', 'Zahdi', 'Ashrasi', 'Barhi' and 'Bream' which were collected from an orchard located in Basra city in Iraq (Figure 1). At least 30 uniform and healthy fruits from each date cultivar were selected and the seeds were separated from the fruits. To completely remove the flesh of the fruit, the seeds were washed with distilled water and kept at ambient (laboratory) temperature for several hours. Then the samples were dried in an electric oven at a temperature of 50 °C for 24 h. The dried seeds were stored in separate plastic bags in the refrigerator.

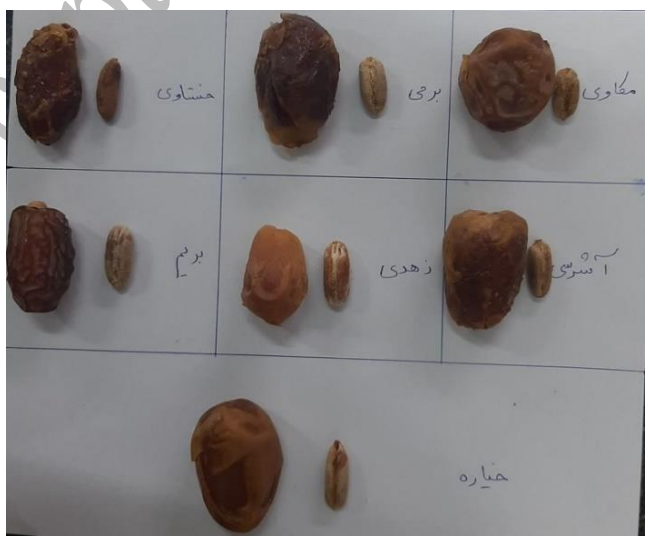

Fig. 1 The fruits and seeds of different date cultivars studied in this experiment

Extraction and Identification of Seed Oil Compounds

To measure the yield and profile of fatty acids in the seed oil, the seeds of the date cultivars were ground to a size of about 1 mm using an electric mill [18]. Oil extraction was performed using the solvent extraction method according to [19]. 10 g of powdered seeds were soaked in hexane solvent for 6 h. After oil extraction, a rotary evaporator was used to separate the solvent from the oil at 45°C [20]. The extracted oil was stored in opaque glass containers at -20 °C until the analysis of the fatty acid composition.

Fatty acids were converted into their methyl esters according to the following method. 0.5 g of extracted oil were placed in glass screw -cap vials and 1 ml of 1 N MeOH/HCL was added. The mixture was vortexed briefly, then incubated at 85 °C for 24 h to ensure complete derivatization. After removal from the oven, vials were cooled to room temperature, then 250 µl of 0.9% KCl was added, followed by 1600 µl of hexane. The mixture was vortexed and after phase separation, an aliquot of upper phase which contained fatty acids to methyl esters was collected for analysis [19].

The identification of the composition of fatty acids in the oil samples was performed by gas chromatography (Agilent Technologies 6890 N GC system), equipped with a flame -ionization detector (GC-FID). Gas Chromatography is worked under the following conditions. Capillary column Hp - 88 (100m × 0.25mm × 0.2µm); nitrogen with 99.9% purity was the carrier gas and the column flow rate was 1 ml/min. The Oven temperature was kept at 100 °C for 5 min and increased to 240 °C at a rate of 4 °C/min and maintained at 240 °C for 30 minutes. The temperature of the injection port and detector were 260 °C and 250 °C, respectively. 2 µL of oil samples were injected automatically. The experiment was conducted in the central laboratory of Islamic Azad University, Isfahan (Khorasgan) Branch.

The identification of fatty acids in the seed oil of different date cultivars was carried out using the standard mixture of fatty acids available in the laboratory and based on retention time, and finally, the types of saturated and unsaturated fatty acid compounds in the seeds were reported in percentage terms.

Measurement of the Contents of Mineral Nutrients

To determine the concentration of mineral nutrients in the seeds of the date cultivars, the powder of seed samples was ashed at 550 °C and the contents of minerals were measured by an inductively coupled plasma (ICP) device based on the Iranian national standard methods.

Statistical Analysis

This study was conducted based on the completely randomized design with three replications. Data analysis was performed using the SAS statistical software and the mean comparison was done based on the least significant difference (LSD) test and at 5% probability level.

RESULTS

Oil Percent

The examination of seed oil showed a significant effect of cultivar type on the content of date seed oil. ‘Khyara’ with 6.3% and ‘Barhi’ with 4.0% had the highest and lowest amount of seed oil, respectively (Figure 2). Oil content in ‘Mekawi’, ‘Khastawi’, ‘Zahdi’ and ‘Ashrasi’ was not statistically different (4.4-5.0%).

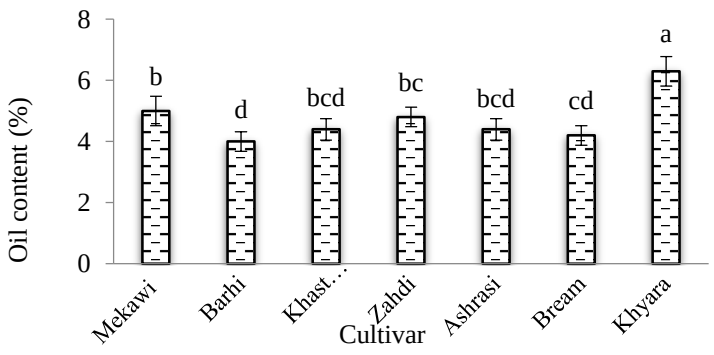

Fig. 2 Oil content of the seeds of different date cultivars. Means with the same letters are statistically similar according to the LSD test (P≤0.05).

Saturated Fatty Acids in Seed Oil

The effect of cultivar was significant on the type and content of fatty acids (Table 1). The highest contents of saturated fatty acid caprylic acid (C8:0) was observed in 'Mekawi' and 'Barhi', capric acid (C10:0) in 'Mekawi', and myristic acid (C14:0) in 'Khastawi'. In terms of lauric acid (C12:0) 'Mekawi', 'Barhi', 'Brim' and 'Ashrasi' had no significant difference. Also, 'Zahdi' and 'Khastawi' cultivars had the highest contents of this saturated fatty acid with 11.99% and 10.80% of palmitic acid (C16:0), respectively. The highest contents of stearic acid (C18:0), arachidic acid (C20:0) and behenic acid (C22:0) were found in 'Zahdi' (3.76%), 'Khiyera' (0.19%) and 'Zahdi' (0.42%), respectively.

Monounsaturated Fatty Acids

The results of the analysis of fatty acids showed that palm seed oil had monounsaturated fatty acids such as palmitoleic (C16:1), oleic (C18:1) and gonodoic acid (C20:1), which have different amounts in different cultivars (Table 1). The highest amount of palmitoleic acid (0.16%) was observed in 'Mekawi', 'Khastawi' and 'Khyara'. The amount of oleic acid did not show a significant difference between the studied cultivars. 'Ashrasi' had the highest amount of gonodoic acid (0.53%) compared to other cultivars, but it had a significant difference only with 'Bream' and 'Khastawi' (Table 1).

Polyunsaturated Fatty Acids

According to Table 1, the highest amount of linoleic acid (C18:2) was observed in Khastawi, which was significantly different only from 'Zahdi'. Meanwhile, the highest amount of gamma-linolenic acid (C18:3) and eicosapentaenoic acid (C20:5) was observed in 'Zahdi' (Table 1).

Mineral Composition of Seeds

The effect of date cultivar on the content of macronutrients in the seeds was significant (Table 2). The content of phosphorus in 'Khyara' (0.35%) and 'Bream' (0.32%) was significantly higher than that in other cultivars; however, these plants had the lowest content of potassium among the studied cultivars. 'Khastawi', 'Ashrasi' and 'Zahdi' cultivars had the highest content of calcium. 'Mekawi' had the lowest magnesium content among the studied cultivars; however, the other cultivars had a similar content of magnesium. 'Khyara' and 'Zahdi' had the highest content of sulfur among the cultivars with 72.5 and 70 mg/kg, respectively.

The date cultivar had different contents of micronutrients (Table 3). Sodium content in the seeds of 'Ashrasi' (136.0 mg/kg) was significantly higher than the other cultivars. 'Mekawi' (2.50 mg/kg) and 'Barhi' (3.56 mg/kg) had the lowest sodium among the studied cultivars. The highest content of iron (21.4 mg/kg) was found in 'Ashrasi'. 'Mekawi' had the lowest iron content (8.44 mg/kg). The highest content of copper was found in 'Zahdi' (4.38 mg/kg) and 'Bream' (4.35 mg/kg) and 'Mekawi' had the lowest content of this element (1.1 mg/kg). The highest and lowest zinc content was detected in 'Ashrasi' (6.65 mg/kg) and 'Mekawi' (0.23 mg/kg), respectively. Manganese content in 'Khyara' (7.89 mg/kg) was significantly higher than that in other cultivars, but there was no significant difference between 'Khastawi', 'Zahdi', 'Ashrasi' and 'Barhi' cultivars in terms of manganese content.

Table 1 Effect of date cultivar on seed fatty acid profile

Cultivar	C8:0	C10:0	C12:0	C14:0	C16:0	C17:0	C18:0	C20:0	C22:0	C16:1
Mekawi	0.32 a	0.34 a	26.06 a	11.47 ab	10.20 b	0.09 c	2.83 bc	0.13 bc	0.25 c	0.16 a
Barhi	0.35 a	0.29 b	24.86 ab	11.64 ab	9.46 b	0.11 b	2.78 c	0.11 c	0.28 bc	0.10 c
Khastawi	0.13 d	0.28 bc	21.34 bc	12.60 a	10.80 ab	0.28 a	3.25 b	0.14 b	0.29 bc	0.16 a
Zahdi	0.00 e	0.00 d	20.63 c	12.07 ab	11.99 a	0.00 f	3.76 a	0.00 d	0.42 a	0.00 e
Ashrasi	0.26 b	0.26 bc	23.31 abc	11.91 ab	10.21 b	0.05 e	2.62 c	0.13 bc	0.27 bc	0.12 b
Bream	0.26 b	0.29 b	24.14 abc	11.36 ab	9.50 b	0.07 d	2.78 c	0.11 c	0.24 c	0.08 d
Khyara	0.19 c	0.24 c	21.49 bc	10.53 b	10.23 b	0.09 c	3.02 bc	0.19 a	0.32 b	0.16 a

Cultivar	C18:1 (n-9)	C20:1 (n-9)	C18:2 (n-6)	C18:3 (n-6)	C20:5 (n-3)	Total SFA	Total USFA	USFA/SFA	MUSFA	PUSFA
Mekawi	39.54 a	0.48 ab	7.28 ab	0.25 b	0.18 bc	51.69 a	47.89 a	0.93 b	40.18 a	7.71 ab
Barhi	41.41 a	0.50 ab	7.44 ab	0.27 b	0.16 bc	49.88 a	49.88 a	1.00 ab	42.01 a	7.87 ab
Khastawi	41.23 a	0.43 b	8.36 a	0.29 b	0.20 b	49.11 a	50.67 a	۱.۰۳ ab	41.82 a	8.85 a
Zahdi	39.82 a	0.48 ab	6.65 b	0.56 a	0.37 a	48.87 a	47.88 a	0.98 ab	40.30 a	7.58 b
Ashrasi	42.46 a	0.53 a	7.25 ab	0.29 b	0.20 b	49.02 a	50.85 a	1.04 ab	43.11 a	7.74 ab
Bream	42.49 a	0.44 b	7.44 ab	0.25 b	0.15 c	48.75 a	50.85 a	1.04 ab	43.01 a	7.84 ab
Khyara	44.85 a	0.50 ab	7.65 ab	0.19 c	0.17 bc	46.30 a	53.52 a	1.16 a	45.51 a	8.01 ab

Means with the same letters are statistically similar according to the LSD test (P≤0.05).

Table 2 The effect of cultivars on the content of macro elements in date seeds

Cultivar	P (%)	K (%)	Ca (mg kg^{-1})	Mg (mg kg^{-1})	S (mg kg^{-1})
Mekawi	0.27 bc	0.44 a	163.0 e	376.0 b	2.50 d
Barhi	0.26 cd	0.33 b	268.0 d	485.0 a	4.73 d
Khastawi	0.22 d	0.43 a	403.0 a	516.0 a	20.10 b
Zahdi	0.31 ab	0.38 ab	335.0 bc	493.0 a	70.00 a
Ashrasi	0.31 ab	0.33 b	354.0 ab	467.0 a	11.60 c
Bream	0.32 a	0.26 c	296.0 cd	493.0 a	2.50 d
Khyara	0.35 a	0.25 c	269.0 d	477.0 a	72.50 a

Means with the same letters are statistically similar according to the LSD test (P≤0.05).

Table 3 The effect of cultivars on the content of micro elements in date seeds.

Cultivars	Na (mg kg^{-1})	Fe (mg kg^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})	Mn (mg kg^{-1})
Mekawi	2.50 e	8.44 e	1.10 d	0.23 e	4.49 d
Barhi	3.56 e	13.00 c	3.15 b	4.22 b	5.88 bc
Khastawi	57.80 b	14.00 c	2.36 c	2.77 c	6.50 b
Zahdi	36.70 c	13.00 c	4.38 a	4.44 b	6.45 bc
Ashrasi	136.0 a	21.40 a	3.51 b	6.65 a	6.09 bc
Bream	2.50 e	17.40 b	4.35 a	4.07 b	5.64 c
Khyara	22.40 d	11.10 d	3.01 b	1.15 d	7.89 a

Means with the same letters are statistically similar according to the LSD test (P≤0.05).

DISCUSSION

The results showed that there were large genetic differences among date cultivars and their influence on oil percentage, saturated and unsaturated fatty acid content and composition. Studies have shown that genotype and environmental factors such as temperature, carbon dioxide concentration, water stress and nutrients affect oil content and fatty acid composition in oilseed products [21]. The content and composition of fatty acids in date seed oil can change under the influence of cultivar, ripening stage and extraction method [22].

The highest seed oil content was observed in 'Khyara' (6.3%), followed by 'Mekawi', 'Zahdi', 'Khastawi' and 'Ashrasi', respectively. Date seed oil had 46.3-51.6% of saturated fatty acids, 40.1-45.5% of monounsaturated fatty acids, and 7.58-8.85% of polyunsaturated fatty acids. Studying the content and type of fatty acids in seeds of date cultivars the profile and content of fatty acids were different in different cultivars [22]. In this study, the content of oleic acid varied from 41 to 59% in different cultivars. Investigated two cultivars 'Allig' and 'Deglet Nour' indicated that these varieties have significant differences in terms of oleic, linoleic, lauric and palmitic acid content. The dominant fatty acid in both cultivars was oleic acid, which was 47.7% in 'Allig' cultivar, and 41.3%. in 'Deglet Nour'. Also, the 'Allig' variety had the highest content of palmitic acid (15%) and linoleic acid (21%), while the highest content of lauric acid (17.8%) and myristic acid (9.8%) was observed in 'Deglet Nour' [23]. Grape seeds also have a significant amount of oil. According to the results of a study, grape seed oil had 10.5% saturated fatty acids, 14.3% monounsaturated fatty acids and 74.7% polyunsaturated fatty acids [24]. On the other hand, by examining the composition of coconut oil, it was found that this crop had 82.5% saturated fatty acids, 6.3% monounsaturated fatty acids and 1.7% polyunsaturated fatty acids [25]. The present study uncovered that the content of saturated fatty acids in date seed oil is more than that in grape and less than in coconut oil; therefore, nutritionally, date seed oil is healthier than coconut oil. Also, date seed oil has a higher content of monounsaturated fatty acids (45.51-40.18%) than coconut oil (6.3%) and grape seed oil (14.3%).

The difference between saturated and unsaturated fatty acids lies in the number of double bonds in the fatty acid chain. Saturated fatty acids do not have double bonds between individual carbon atoms, while unsaturated fatty acids have at least one double bond in the fatty acid chain. This difference in molecular structure causes unique characteristics in terms of the physiological characteristics of fatty acids and health in humans [26]. Certain diets, which are rich in polyunsaturated fatty acids and monounsaturated fatty acids, have a positive effect on human health and can act as precursor molecules in immune signaling pathways. Also, the findings of clinical trials

using unsaturated fatty acids have proven the anti-inflammatory properties of these fatty acids [27]. On the other hand, replacing saturated fatty acids with unsaturated fatty acids in the diet significantly reduces the risk of heart disease, blood vessel occlusion, and as a result, heart attack and death [28]. Most of the fatty acids are synthesized in the body, but the human body lacks the enzymes needed to produce two fatty acids, alpha-linolenic acid (omega-3) and linoleic acid (omega-6), which are called essential fatty acids and must be obtained from the diet. Although the body can increase dietary alpha-linolenic acid to long-chain eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), their synthesis rate may not be sufficient to meet the body's needs, so it is recommended that good sources of these fatty acids it is included in the diet [29]. The results of this research showed that date seed oil has adequate amounts of omega-6 fatty acids (linoleic acid and gamma-linolenic acid) in different cultivars. These fatty acids help to improve heart efficiency, reduce blood cholesterol and reduce inflammation [30, 31]. Coniglio *et al*. (2023) [27] showed that 8.5% of olive oil consists of linoleic acid. Therefore, the seed oil of date cultivars, especially the 'Khastawi', with 8.36% of this fatty acid, is a rich source of linoleic acid.

Oleic and linoleic fatty acids were investigated in sunflower, olive, avocado, rapeseed, mustard, walnut, grape seed and peanut oils. The results of this research showed that the highest amount of oleic acid is in sunflower oil (80%), olive oil (68.8%), rapeseed (63.6%), mustard (36.6%) and grape seed oil (19.9%). While the highest amount of linoleic acid is in sunflower oil (70.0%), grape seed oil (68.1%), walnut (55.5%), peanut (23.6%) and Mustard (22.0%) was observed [27]. On the other hand, the results obtained from the examination of date seed oil showed that 44.8-39.5% of oleic acid in the seeds of different cultivars, which compared to sunflower, olive and rapeseed oil, has less oleic acid and compared to grape seed oil. It has more oleic acid.

All nuts and seeds contain low levels of saturated fatty acids and high levels of unsaturated fatty acids. Linoleic acid and alpha-linolenic acid are two essential fatty acids for humans and precursors of C20 and C22 unsaturated fatty acids [32]. The use of date oil as an edible oil is very important due to its valuable chemical compounds and physicochemical properties. This product is rich in oleic acid, which has great nutritional importance. The content of saturated fatty acids in date seed oil, as well as the presence of many antioxidants (phenolic compounds and carotenoids) protect this product against oxidative damage [19] and thermal damage [33] making it very stable and suitable for cooking, seasoning oil and even as a substitute for palm oil [3]. On the other hand, date seed oil protects the skin against UV-A and UV-B rays, which cause many cells damage to the skin [34]. From this point of view, it is very important to investigate different varieties of dates in terms of the type and content of fatty acids and nutrient elements.

The results of an experiment showed that the contents of magnesium (655.53 µg/g), calcium (95.12 µg/g), copper (5.24 µg/g), zinc (0.23-6.65 µg/g) and manganese (14.82 µg/g) in seeds of Bahrain variety were higher than that in our varieties [17]. However, a comparison of the results obtained from our date cultivars showed that the studied cultivars had more magnesium (516-376 mg/kg), copper (1.1-38.4 mg/kg), zinc (23 65.0-6 mg/kg) and manganese (89.7-49.4 mg/kg) calcium (403-163 mg/kg) than Bahrain variety.

Adeosun *et al*. (2016) [36] investigated the mineral nutrients of a date seed and reported that sodium, potassium, calcium, magnesium, iron, phosphorus and zinc were 0.67, 78.12, 18.20, and 48 respectively. There were 0.0, 0.82, 19.32 and 0.25 mg per 100 grams of dry weight in the seeds [36]. Compared to the cultivars studied in the present study, the amount of calcium, magnesium, iron and zinc in the cultivar studied by Adeosun *et al*. (2016) [36] was lower. In another research mineral elements of seeds of five different species were investigated. In wheat, corn, rice, soybean and lentil seeds, calcium (340, 64, 100, 1950 and 340 mg/kg), magnesium (1200, 850, 360, 4070 and 460 mg/kg) and zinc (30, 16, 8, 37 and 32 mg/kg) were observed [37]. The comparison of the content of mineral elements of these plants with the studied date varieties confirmed that date seeds have more calcium compared to wheat, corn, rice and lentils. Also, the content of magnesium in date seeds was higher than that of rice and lentils, but the content of zinc was lower compared to wheat, corn, rice, soy and lentils. Adequate intake of calcium is vital for the formation and maintenance of a healthy skeleton, and high consumption of calcium along with vitamin D has preventive effects against bone loss. Lack of calcium in the diet increases blood pressure and increases the risk of colon cancer [38]. On the other hand, magnesium is responsible for activating more than 300 enzymes that help maintain the function of muscles and nerves in the body. People with magnesium deficiency are tired, irritable and nervous and have trouble concentrating. Also, magnesium

deficiency causes disturbances in the body's biochemical function, especially the nervous and muscular systems, and increases stress and depression [39].

Studying rapeseed showed that the type of variety has a significant effect on the content of mineral elements such as calcium, magnesium, copper, sodium and sulfur. Also, the analysis of the data showed that the nutritional value of different canola cultivars was different in terms of minerals [40]. In the study of the seeds of different grape varieties, reported that the amount of phosphorus, potassium, calcium, magnesium and sulfur depends on the type of variety and the type of soil. They reported the amount of phosphorus between 3731 and 4309.3 mg/kg and the amount of potassium between 10033 and 16674 mg/kg. Also, the amount of calcium varied between 1969 mg/kg in 'Cabernet' cultivar and 2678 mg/kg in 'Muscat' cultivar [41].

Date seeds were identified as a rich source of valuable medicinal and food compounds that can help fight inflammatory diseases, infections and disorders related to oxidative stress. Extracted oil from date seeds, which is a troublesome waste product, is economically beneficial. Based on its chemical composition, palm seed oil can be presented as a new oil with interesting and diverse applications, from human food (cooking, frying, seasoning or salty oil) to medicinal, cosmetic and even biodiesel applications from waste to raw materials for several industrial activities. The present research revealed that the content and type of fatty acids and mineral elements are different in different cultivars of dates. So, the highest percentage of seed oil was observed in 'Khyara' cultivar with a content of 6.3%. 'Mekawi' cultivar had the highest content of saturated fatty acids such as caprylic and lauric acid and 'Khastawi' had the highest content of myristic acid, while the highest content of saturated fatty acids such as linoleic acid was observed in 'Khastawi' cultivar and linolenic acid in 'Zahdi'. Therefore, the results of the current study indicated that measurement and selecting the right cultivar according to the desired goal can prevent the waste of time, energy and costs.

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