Mineral Contents of Fruits of Six Leading Date Cultivars of Southern Libya

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ABSTRACT

Nine nutrient elements (Ca, P, Na, K, Cl, Mn, Zn, Cu and Fe) were determined at tamar stage, in six leading southern Libyan date cultivars: Taleese, Seloulou, Taghiat, Tasfert, Aspear and Adwi. Lowest and highest values of cultivars mineral content as mg/100 g dried flesh were as follows: K 556.0 for Taleese and 864.2 for Adwi; Cl 279.5 for Taleese and 610.9 for Adwi; Ca 54.4 for Aspear and 63.4 for Seloulou; P 43.7 for Adwi and 81.3 for Taleese; Na 9.01 for Tasfert and 13.88 for Taghiat and Aspear; Mn 5.74 for Seloulou and 13.48 for Aspear; Fe 2.17 for Adwi and 3.42 for Taghiat; Zn 4.80 for Tasfert and 7.60 for Taleese; Cu 0.42 for Tasfert and 0.46 for Taleese. Other cultivars were intermediate. Generally, Libyan dates compared to leading world cultivars were relatively poor in minerals. It was concluded that 100 g of dried flesh might furnish about 38% of Zn, 28% of Fe, 26% of Cu, 20% of Mn, 27% of K, 7% of Ca and P and 0.2% of Na of the human daily requirement.

INTRODUCTION

In many parts of the Arab world, dates are considered to be an essential source of food. The Arab countries produce more than 70% of total world production of dates and annual production is estimated at 1,310,000 metric tons (8). Minerals and sugars are the most important components that dates contribute to human diet. A wide variation in the mineral content of the world's leading date cultivars was reported by several investigators (4,5,9,10,13). Range in mg/100 grams dry flesh were as follows: Potassium 575–1480; Calcium 56–200; Phosphorus 13–300; Sodium 5–240; Chloride 260–342; Manganese 0.3–5.8; Iron 0.7–8.0; Zinc 0.74–1.82; and Copper 0.60–2.89. To the best of our knowledge, no studies on the mineral content of Libyan dates have been reported. Therefore, this study was carried out to determine the mineral contents of six leading southern Libyan date cultivars: Taleese, Seloulou, Taghiat, Tasfert, Aspear, and Adwi. Sugar content and physical characters of these cultivars had already been reported (7). The determination of mineral content of dates is beneficial when evaluating their nutritional value in supplementing human daily requirement of minerals. It could also be helpful in planting-fertilization programmes, since the amount of minerals in the crop is taken from the tree, and should be made up by replenishing the tree with fertilizers. Moreover, the determination of minerals in Libyan dates, will enable comparison with world leading cultivars.

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MATERIALS AND METHODS

Six leading cultivars of southern Libyan dates (*Phoenix dactylifera* L.) were selected for the present study; namely: Tasfert, Taghiat, Taleese, Adwi, Aspear and Seloulou. Date-fruit samples were collected in October 1978, at tamar stage from three major date-growing districts of southern Libya (Sebha, Ubari and El-Shatie). Samples of Sebha and Urabi districts were collected from seven orchards at different locations in each district. Fruit samples consisting of several hundred fruits, were randomly collected from 3 trees in each orchard. Fruit samples from different locations of El-Shatie were supplied by farmers participating in the date exhibition held at Sebha in October 1978. No attempts were made to grade or sort out the fruits, whether collected or supplied by farmers. Cull and inferior fruits of all districts were eliminated.

Fifty fruits from each sample were taken at random and used for chemical analysis. These fruits were deseeded, dried in draft oven at 65°C to a constant weight, and ground. Three grams from the ground samples were digested and analyzed for minerals according to Chapman and Pratt (3). Analysis for K, Ca, and Na was by flame photometry, Zn and Cu by atomic absorption, P, Mn and Fe by spectrophotometer and Cl by titration with silver nitrate. All data were expressed as mg/100 g dried flesh. Difference among cultivars were subject to statistical analysis using analysis of variance.

RESULTS AND DISCUSSION

The mineral content of the fruits of the six leading cultivars grown in Sebha, Ubari and El-Shatie are presented in Table 1; Tables 2 and 3 show the overall average of minerals and their percentages in ash, respectively.

Ash: No great variations in the amounts of ash were found among the different cultivars used in this study. Values obtained were similar to those reported on American dates (9), but higher than Iraqi dates (12) and lower than the Khalas dates of Saudi Arabia (10).

Macro-nutrients

Potassium: Amounts of K were found in excess of any other element determined in this study. Potassium was over 10 times the amount of Ca and P in the flesh of fruits. Potassium also covered more than 25% of the minerals present in ash (Table 3). The predominant presence of K in dates was noted by other investigators (6,9,11,13). Values of K found in this study were generally lower than those reported for many leading date cultivars (6,9,10,11,13); Hass (9) and Cleveland (4) showed that half of the dates ash was K.

Calcium and Phosphorous: Amounts of Ca and P present in the flesh and ash of dates were found about equal. Similar results were reported by Hussein and El-Zeid (10). Other reports indicated that dates contained greater amounts of Ca than P (6,9,11,13). The values of Ca and P obtained in this study were generally lower than those of leading world cultivars (5,6,9,10,11,13). This could be attributed to variation in agroclimatic conditions. In the present study, no variations among cultivars were shown as to their Ca content, but P was found highest in the fruits of Taleese (Table 2).

Table 1 Inorganic content of six leading date cultivars grown in Sebha, Ubari, and El-Shatie of Southern Libya.

Inorganic constituents	District	Cultivar						Average
		Aspear	Seloulou	Tasfert	Adwi	Taghiat	Taleese	
		mg/100 gm dry flesh						
	Sebha	2527	2817	2531	3003	2828	2189	2646
Ash	Urabi	2003	2185	2464	2982	3295	2079	2502
	El-Shatie	2604	2412	3391	2393	2197	2616	2602
	Sebha	718.0	690.9	671.3	934.1	704.4	582.1	695.4
K	Ubari	558.9	675.3	619.2	796.4	780.1	674.8	701.4
	El-Shatie	761.5	696.1	834.5	896.6	683.1	427.8	714.1
	Sebha	443.8	514.8	447.7	683.4	443.8	284.0	469.6
Cl	Ubari	177.5	466.8	488.1	678.9	585.8	306.3	450.6
	El-Shatie	514.8	647.9	497.0	470.4	541.4	248.3	486.6
	Sebha	52.0	49.8	71.2	41.5	52.5	79.6	62.5
P	Ubari	52.5	56.7	46.2	38.5	75.5	56.2	49.2
	El-Shatie	56.9	64.7	69.5	52.5	73.6	75.0	64.2
	Sebha	57.6	74.1	51.7	68.9	47.7	67.7	59.43
Ca	Ubari	61.7	61.7	52.7	63.7	72.8	55.6	60.67
	El-Shatie	51.0	58.0	65.5	61.3	50.0	54.6	56.46
	Sebha	11.49	9.30	11.35	11.90	13.22	11.68	11.69
Na	Ubari	5.20	9.91	6.02	8.32	11.10	4.73	7.70
	El-Shatie	17.06	10.01	9.30	10.04	18.00	14.73	13.18
	Sebha	1.12	0.30	0.92	0.64	0.61	0.75	0.72
Mn	Ubari	0.78	0.53	0.49	0.23	0.63	0.43	0.51
	El-Shatie	2.15	0.91	0.64	0.91	0.85	1.61	1.18
	Sebha	2.17	1.93	3.72	2.62	2.44	2.69	2.75
Fe	Ubari	2.71	2.03	3.13	1.54	5.76	1.89	2.78
	El-Shatie	3.16	3.91	2.10	2.60	2.71	2.87	2.99
	Sebha	5.3	5.3	1.9	5.2	4.6	9.1	5.2
Zn	Ubari	5.6	7.0	4.7	6.3	3.9	7.5	5.8
	El-Shatie	5.3	6.0	7.7	4.9	6.3	6.2	6.1
	Sebha	0.48	0.44	0.44	0.52	0.44	0.59	0.49
Cu	Ubari	0.52	0.59	0.29	0.44	0.59	0.44	0.48
	El-Shatie	0.44	0.44	0.52	0.52	0.52	0.89	0.56

Table 2 The overall average of inorganic constituents in six leading date cultivars of Southern Libya.

Inorganic constituents	Cultivars						Average of all orchards
	Aspear	Seloulou	Tasfert	Adwi	Taghiat	Taleese	
	mg/100 g dry flesh						
Ash	2373^{a}	2473^{a}	2793^{a}	2790^{a}	2773^{a}	2297^{a}	2583
K	724.5^{ab}	689.0^{b}	687.6^{b}	864.2^{a}	718.0^{ab}	556.0^{b}	703.3
Cl	378.7^{bc}	543.2^{ab}	477.6^{abc}	610.9^{a}	523.7^{ab}	279.5^{c}	468.9
Ca	54.4^{a}	63.4^{a}	55.0^{a}	63.2^{a}	54.6^{a}	60.9^{a}	58.8
P	54.7^{b}	58.1^{b}	56.8^{b}	43.7^{b}	59.3^{b}	81.3^{a}	59.4
Na	13.88^{a}	9.79^{ab}	9.01^{b}	9.77^{ab}	13.88^{a}	11.02^{ab}	11.07
Mn	1.35^{a}	0.58^{b}	0.69^{b}	0.59^{b}	0.70^{b}	0.93^{ab}	0.81
Fe	2.85^{a}	2.94^{a}	3.16^{a}	2.17^{a}	3.42^{a}	2.55^{a}	2.84
Zn	5.4^{a}	6.1^{a}	4.8^{a}	5.5^{a}	4.9^{a}	7.6^{a}	5.7
Cu	0.48^{a}	0.49^{a}	0.42^{a}	0.49^{a}	0.52^{a}	0.64^{a}	0.51

Means in each row followed by the same letter are not significantly different at $P = 0.05$ according to D.N.M.R.T.

Table 3 The percentages of inorganic constituents in the ash of flesh of six leading date cultivars of Southern Libya.

Inorganic minerals (% in ash)	Cultivar						Average of all orchards
	Aspear	Seloulou	Tasfert	Adwi	Taghiat	Taleese	
K	28.58[a]	28.07[a]	25.44[a]	31.79[a]	26.55	25.10[a]	27.58
Ca	2.44[a]	2.62[a]	2.04[a]	2.33[a]	2.06[a]	2.61[a]	2.34
P	2.29[ab]	2.34[ab]	2.24[ab]	1.62[b]	2.31[ab]	3.06[a]	2.31
Na	0.460[a]	0.400[a]	0.320[a]	0.370[a]	0.543[a]	0.440[a]	0.421
Mn	0.055[a]	0.024[b]	0.025[b]	0.022[b]	0.026[b]	0.038[ab]	0.032
Fe	0.113[a]	0.103[a]	0.113[a]	0.082[a]	0.128[a]	0.107[a]	0.108
Zn	0.235[ab]	0.251[ab]	0.165[b]	0.195[b]	0.181[b]	0.353[a]	0.230
Cu	0.021[ab]	0.020[ab]	0.014[b]	0.018[ab]	0.014[ab]	0.027[a]	0.020

Means in each row followed by the same letter are not significantly different at P = 0.05 according to D.N.M.R.T.

Chloride: Appreciable amounts of chloride were found in the fruits of all cultivars. The values of Cl found were higher than those reported on Iraqi dates (13). Unlike Bliss and Hass (1) who indicated that values of Cl resembled those of Na. In the study, Cl was found over 40 times the amount of Na. This might be due to variation in soil and/or cultivars. As for Libyan dates, fruits of Adwi were highest in Cl, while those of Taleese were lowest (Table 2).

Sodium: Amounts of Na in the flesh and ash of Libyan dates were much lower than macro-elements determined in this study. However, values of Na were within ranges reported for Iraqi dates (6,13), and lower than American and Egyptian dates (11). The fruits of Aspear and Taghiat were highest in Na, while those of Tasfert were lower (Table 2).

Micro-nutrients

No significant variations were found among cultivars, as to their Fe, Zn and Cu contents—whereas Mn was significantly higher in the fruits of Aspear and Taleese than those of other cultivars. The micro-nutrients constituted only a small portion of the ash of flesh (Table 2). Libyan dates, compared to some world's leading cultivars, were generally low in Mn and Cu (6,11,13), high in Zn (13) and normal in Fe content (6,9,11,13).

Comparing the three districts as to the mineral contents of dates, no great variations were noticed among them, except the district of Ubari where it was relatively low in P, Na and Mn (Table 1).

Generally it was observed that Libyan dates, compared to leading world cultivars, were relatively poor in minerals. This could be attributed to climatic factors and/or cultivars. On the other hand, the negligence of palm trees and poor maintenance of orchards, especially lack of fertilization, would certainly lead to mineral deficiency. Authors would like to emphasize this point, and urge authorities to pay more attention and take care of productive palm trees, or those that have been recently planted.

Nutritive value

The human daily requirements of inorganic nutrients were estimated as follows:

Potassium and Na 2.5 gm, Ca and P 800 mg, Fe 10 mg, Mn 4 mg, Zn 15 mg and Cu 2 mg (2).

From the results shown in Tables 1 and 2, one could conclude that 100 gm of dried flesh (about 12 fruits of Seloulou and 14–16 fruits of the other cultivars) might furnish more than 38% of Zn, 28% of Fe, 26% of Cu, 20% of Mn, 27% of K, 7% of Ca and P and 0.2% of Na, of the human daily requirement.

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مستخلص

التركيب المعدنى لثمار ستة أصناف من التمور الليبيه

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قدرت تسعة عناصر غذائية (كالسيوم ، فوسفور ، بوتاسيوم، صوديوم، كلوريد ، منجنيز ، حديد ، زنك ، نحاس) فى ثمار ستة اصناف رئيسيه من التمور الليبية هى تاليس ، تاغيات ، تاسفرت ، سلولو اسبير واضوى وقد تم جمع العينات من عدة مزارع فى كل من سبها واوبارى والشاطىء .

وتبين من التحليل أن أقل وأعلى تركيز (ملليغرام/١٠٠ جرام ماده جافه) للمكونات المعدنيه للتمور الليبية كانت كما يلى :

بوتاسيوم :	٥٥٦ فى تاليس ،	٨٦٤ر٢	فى اضوى
كلوريد :	٢٧٩ر٥ فى تاليس ،	٦١٠ر٩	فى اضوى
كالسيوم :	٥٤ر٤ فى اسبير ،	٦٣ر٤	فى سلولو
فوسفور :	٤٣ر٧ فى اضوى ،	٨١ر٣	فى تاليس
صوديوم :	٩ر٠١ فى تاسفرت ،	١٣ر٨٨	فى تاغيات واسبير
منجنيز :	٥ر٧٤ فى سلولو ،	١٣ر٤٨	فى اسبير
حديد :	٢ر١٧ فى اضوى ،	٣ر٤٢	فى تاغيات
زنك :	٤ر٠٨ فى تاسفرت ،	٧ر٦	فى تاليس
نحاس :	٠ر٤٢ فى تاسفرت ،	٠ر٤٦	فى تاليس

بالنسبة للرماد فقد كانت نسبته ٢٢٩٧ فى تاليس و ٢٧٩٣ فى تاسفرت .

أما من حيث القيمة الغذائية للتمور الليبية فقد وجد أن كل ١٠٠ جرام ماده جافه (حوالى ١٤ ثمره) تحتوى على النسب التالية من احتياجات الانسان اليومية : ٣٨ ٪ زنك ، ٢٨ ٪ حديد ، ٢٦ ٪ نحاس ، ٢٠ ٪ منغنيز ، ١٤ ٪ بوتاسيوم ، ٧ ٪ كالسيوم وفسفور ، ٢ر٠ صوديوم . وقد لوحظ أن التمور الليبية كانت فقيره نسبيا فى العناصر الغذائية عند مقارنتها بالتمور العالمية .

لذا يرى الباحثون ضرورة الاهتمام والعنايه بأشجار النخيل المثمرة وحديثة الانشاء .