

## **Chemical Analysis of Fruits of Some Saudi-Grown Date Palm Cultivars with Emphasis on Their Mineral Content**

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The chemical composition of the fruits of 11 date palm cultivars grown at Riyadh region was studied during 1983 season. Results showed that most of the studied characters (moisture, TSS, acidity, protein and crude fat) of both flesh and seeds differed from one cultivar to another. Ash content ranged from 1.88-2.96% in the flesh and 0.99-1.38% in the seeds of different cultivars. Also, mineral contents of both were found to vary among the eleven date palm cultivars. Nitrogen and potassium contents were higher as compared to the other minerals in the different cultivars. The data also revealed that the studied fruits are a good source of various mineral elements.

Date palm tree is a very important traditional fruit tree in Saudi Arabia. Nowadays, Saudi Arabia is considered as one of the leading date producing countries in the world. Its annual production from dates is estimated at about 440,000 tons in 1983 (FAO 1984). In many regions of Saudi Arabia, date fruits still constitute an important part of the diet of most people. Seeds are also considered an important material for feeding livestock (Sarsam *et al.* 1955).

The chemical composition of the fruits of various date palm cultivars grown at different countries has been investigated by several workers (Haas 1935, Furr and Cook 1952, Minessy *et al.* 1982). In Saudi Arabia, some investigations are available regarding the chemical composition of the different Saudi Arabian date palm cultivars (About 250 cultivars) such as Hussein *et al.* (1974), Hussein and El-Zeid (1975), Abdel Hafiz *et al.* (1980), and Sawaya *et al.* (1982 and 1984). Therefore, the present investigation was carried out to study the chemical composition of 11 date palm cultivars grown at Riyadh region, with emphasis on the mineral contents of the flesh and seeds. Six of the studied cultivars (Barhi, Khudari, Menefi, Muscani, Nebut Seif and Succari) are of the main cultivars in the central region. Two cultivars (Ruzeiz and Shabibi) are important in the Eastern region, while the remaining three cultivars (Anbara, Berni and Hilwa) are important in the western region.

## Material and Methods

Eleven date palm (*Phoenix dactylifera*. L.) cultivars grown at the orchard of the College of Agriculture, King Saud University, were used in this investigation. The trees were about 12-years-old and were subjected to the same cultural practices. Four samples were taken from each cultivar at the tamar stage. Each sample considered of 100 fruits. Physical properties of the fruits (fruit weight, volume, length, diameter, seed weight and flesh percentage) were determined. Chemical properties of the flesh and seeds were determined. Moisture, acidity (as citric acid), crude fat, protein ( $N \times 6.25$ ) and ash contents were determined according to the A.O.A.C. methods (1975). Total soluble solids were determined by Abbe refractometer.

Mineral content of both flesh and seeds were carried out. Nitrogen was determined by micro-Kjeldahl Gunning method (A.O.A.C. 1975). Phosphorous was determined by the stannous chloride method (Toth *et al.* 1948). Potassium was determined by use of atomic absorption spectrophotometer Perken Elmer 2380 (A.O.A.C. 1975). Calcium and magnesium were determined by the verdate method (Cheng and Bray 1951). Chloride was determined by the silver nitrate method (Jackson and Brown 1955). Iron, zinc and copper were determined using atomic absorption spectrophotometer (A.O.A.C. 1975).

The data obtained were statistically analyzed using analysis of variance and L.S.D. was calculated (Snedecor and Cochran 1967).

## Results and Discussion

### *Physical Properties*

Physical properties (fruit weight, volume, length, diameter, seed weight and flesh percentage) of the 11 cultivars differed from each other (Table 1). Statistical analysis indicated that there were significant differences between the studied cultivars in most cases. Similar results were obtained by Hussein *et al.* (1974).

### *Chemical Properties*

Tables 2 and 3 present the chemical properties of the flesh and seeds of the cultivars under study.

#### a. *Flesh*

Data showed that moisture content varied from 5.52-24.67% according to the cultivar. Also, statistical analysis revealed that there were significant differences between the cultivars. Hilwa and Barhi cultivars had the highest moisture con-

**Table 1. The physical properties of the fruits of the 11 date palm cultivars**

Cultivar	Fruit Weight (g)	Fruit Volume (cc)	Fruit length (cm)	Fruit diameter (cm)	Seed weight (g)	Flesh* (%)
Barhi	9.14	8.25	2.94	2.06	0.83	90.93
Khudari	13.13	11.45	4.51	2.03	0.90	92.43
Menefi	10.29	10.10	3.74	1.88	0.94	90.83
Muscani	6.50	6.45	2.84	1.97	0.73	88.78
Nebut Seif	8.93	8.31	3.73	2.73	0.68	91.00
Succari	10.40	9.75	3.11	2.37	1.22	88.25
Ruzeiz	9.13	8.28	2.86	2.00	0.82	88.83
Shabibi	10.30	9.75	3.37	2.18	0.69	93.28
Anbara	7.58	8.31	3.31	2.04	1.00	86.73
Berni	9.05	9.70	4.26	2.03	1.13	87.50
Hilwa	12.04	11.60	4.22	2.11	1.00	91.50
L.S.D. 5%	1.61	1.50	0.25	0.16	0.08	1.68
1%	2.17	2.03	0.33	0.22	0.10	2.27

\* on fresh weight basis.

**Table 2. The chemical properties of the flesh of the 11 date palm cultivars (on dry weight basis)**

Cultivar	Moisture %	TSS %	Acidity %	Protein %	Ash %
Barhi	24.67	62.25	0.188	3.78	2.69
Khudari	12.79	69.60	0.795	4.36	1.88
Menefi	18.89	63.75	0.175	3.34	2.43
Muscani	17.13	63.75	0.305	3.27	2.96
Nebut Seif	11.85	60.80	0.282	4.27	1.96
Succari	7.94	64.73	0.282	3.89	2.88
Ruzeiz	19.41	64.50	0.190	4.34	2.34
Shabibi	5.52	65.55	0.140	3.38	2.55
Anbara	12.62	60.73	0.568	3.61	2.58
Berni	7.44	67.65	0.522	3.28	2.18
Hilwa	21.75	59.93	0.182	3.06	2.42
Mean	14.55	63.93	0.330	3.69	2.44
L.S.D. 5%	3.72	2.71	0.068	NS	0.37
1%	5.00	3.66	0.091		0.49

tent, whereas, Shabibi, Succari and Berni cultivars had the lowest values. The remaining 6 cultivars had medium moisture content (Table 2). Similar results were obtained by Hussein *et al.* (1974), and Yousif *et al.* (1982) working on different date palm cultivars.

With respect to TSS percentage, date showed that it ranged from 59.93-69.60 per cent. Khudari and Berni cultivars had the highest TSS content. While, Hilwa, Anbara and Nebut Seif had the lowest values. The remaining 6 cultivars were intermediate (Table 2). However, these values are somewhat lower than those reported by Yousif *et al.* (1982) in four Iraqi date palm cultivars.

Acidity content ranged from 0.140-0.795% in the flesh of the various cultivars. Khudari, Berni and Anbara cultivars had the highest acidity values that significantly excelled the other cultivars (Table 2).

Concerning protein content, results showed that it ranged from 3.06 to 4.36%. Statistical analysis indicated that no significant differences were observed between the different cultivars (Table 2). These results are in line with those reported by Abdel Hafiz *et al.* (1980) in 15 date palm cultivars grown in Saudi Arabia, Yousif *et al.* (1982) in four Iraqi date palm cultivars and Sawaya *et al.* (1982) in Khudari, Selej and Sifri date palm cultivars.

Ash content ranged between 1.88 and 2.96%. Significant differences were found between the various cultivars in most cases (Table 2). These results are in agreement with those reported by Hussein *et al.* (1974) and Abdel Hafiz *et al.* (1980). On the contrary, Yousif *et al.* (1982) found that the differences in ash content of the fruit among the various cultivars was negligible.

#### b. Seed

Data of this investigation indicated that moisture content ranged from 5.85-14.99%, it differed from one cultivar to another. Significant differences were found between the various cultivars in most cases (Table 3).

Crude fat and protein contents varied from one cultivar to another. However, the differences were not statistically significant (Table 3). Concerning ash content, it was shown that it ranged from 0.99-1.40%. Significant differences were observed between the studied cultivars (Table 3).

The foregoing results regarding the chemical composition of the seed are generally in line with those obtained by Dowson and Aten (1962) and El-Shurafa *et al.* (1982), but were lower than those found by Hussein and El-Zeid (1975) on Khalas cultivar.

**Table 3. The chemical properties of the seeds of the 11 date palm cultivars  
(on dry weight basis)**

Cultivar	Moisture %	Crude fat %	Protein %	Ash %
Barhi	9.48	6.52	5.70	1.14
Khudari	5.85	6.59	6.25	1.12
Menefi	11.87	6.11	5.84	0.99
Muscani	6.93	7.76	5.28	1.18
Nebut Seif	10.73	7.11	5.92	1.34
Succari	11.97	8.58	7.05	1.16
Ruzeiz	14.99	7.83	6.61	1.38
Shabibi	9.86	6.89	6.31	1.01
Anbara	9.93	7.63	5.21	1.18
Berni	11.36	8.12	6.47	1.40
Hilwa	14.56	6.59	5.25	1.06
mean	10.68	7.25	5.99	1.18
L.S.D. 5%	2.37	NS	NS	0.12
1%	3.20			0.16

Comparing the chemical properties of the flesh and the seeds as an average of the 11 cultivars, data showed that flesh was found to contain higher percentages of moisture and ash, and lower content of protein than the seeds.

### **Mineral Content**

#### **a. Flesh**

Results of this investigation indicated that the flesh of the 11 date palm cultivars contained different amounts of both macro- and micro-elements as shown in Table 4. The statistical analysis revealed that there were no significant differences between the studied cultivars with respect to their content of all studied macro-elements (N, P, K, Ca and Mg). Data also showed that potassium is the predominant macro element in the flesh of the date palm fruits, whereas, phosphorous was found in smaller quantities than the other macro elements (Table 4). Similar results were obtained by Haas (1935), Minessy *et al.* (1974), El-Shurafa *et al.* (1980), Yousif *et al.* (1982), and Sawaya *et al.* (1982).

Regarding the micro elements, data showed that there were no significant differences between the different cultivars in Fe and Zn contents. On the contrary, there were significant differences between the various cultivars with regard to their contents of Cl and Cu (Table 4).

Table 4. The mineral contents of the flesh of the 11 date palm cultivars

Cultivar	N %	P %	K %	Ca %	Mg %	Cl %	Fe ppm	Zn ppm	Cu ppm
Barhi	0.61	0.081	1.32	0.218	0.135	0.595	187.50	26.25	8.25
Khudari	0.70	0.073	1.08	0.250	0.185	0.383	212.50	26.25	5.00
Menefi	0.54	0.059	1.12	0.303	0.140	0.622	206.25	26.25	3.33
Muscari	0.52	0.051	1.36	0.288	0.155	0.845	212.50	28.25	3.75
Nebut Seif	0.68	0.069	1.10	0.330	0.200	0.430	262.50	52.50	3.75
Succari	0.62	0.105	1.21	0.253	0.135	0.728	268.75	50.00	3.33
Ruzeiz	0.70	0.073	1.14	0.270	0.155	0.415	182.50	36.25	3.33
Shabibi	0.54	0.078	1.40	0.283	0.115	0.703	181.25	25.00	3.75
Anbara	0.58	0.069	1.22	0.295	0.143	0.638	237.50	33.75	3.33
Berni	0.53	0.061	1.05	0.280	0.130	0.508	212.50	33.75	3.75
Hilwa	0.49	0.056	1.16	0.243	0.125	0.543	206.25	28.75	3.75
L.S.D. 5%	NS	NS	NS	NS	NS	0.118	NS	NS	1.87
1%						0.159			2.52

Data showed that Cl and Fe are the predominant micro elements, while Zn and Cu were found in small quantities (Table 4). These results are generally in line with those reported by El-Shurafa *et al.* (1980) working on six date cultivars of Libya.

#### b. Seeds

Results in Table 5 showed that there were no significant differences among the various cultivars with regard to their contents of N, P and Mg. On the other hand, significant differences were observed between the contents of K and Ca. Data also showed that N is the predominant macro elements in the seeds of the studied cultivars.

Concerning the micro-elements of the seeds, data showed that there were no significant differences among the cultivars with regard to their contents of Cl and Cu. On the other hand, there were significant differences between the various cultivars in Fe and Zn contents (Table 5).

Comparing the macro-elements of flesh and seeds, data showed that the flesh contained higher concentrations of K, Ca and Mg and lower concentrations of N and P than the seeds. Regarding the micro-elements, the flesh contained higher concentrations of Cl and lower concentrations of Fe and Cu than in the seeds. Zinc concentration was nearly the same in both flesh and seeds (Table 6).

**Table 5. The mineral contents of the seeds of the 11 date palm cultivars**

Cultivar	N %	P %	K %	Ca %	Mg %	Cl %	Fe ppm	Zn ppm	Cu ppm
Barhi	0.91	0.097	0.40	0.160	0.068	0.473	443.75	40.00	5.00
Khudari	1.00	0.131	0.42	0.160	0.085	0.478	316.25	35.00	5.00
Menefi	0.94	0.091	0.42	0.095	0.080	0.503	506.25	27.50	10.00
Muscari	0.85	0.085	0.41	0.143	0.070	0.523	356.25	35.00	7.50
Nebut Seif	0.95	0.087	0.39	0.105	0.050	0.510	550.00	22.50	11.25
Succari	1.13	0.109	0.48	0.163	0.055	0.530	275.00	53.75	10.00
Ruzeiz	1.06	0.109	0.53	0.083	0.050	0.488	312.50	23.75	11.25
Shabibi	1.01	0.100	0.43	0.090	0.053	0.518	562.60	23.75	12.50
Anbara	0.83	0.084	0.44	0.110	0.053	0.460	525.00	33.75	7.50
Berni	1.04	0.086	0.54	0.113	0.068	0.610	475.00	52.50	8.75
Hilwa	0.84	0.106	0.38	0.150	0.075	0.525	437.50	17.60	6.25
L.S.D. 5%	NS	NS	0.08	0.050	NS	NS	159.05	18.92	NS
1%			0.11	0.067			214.42	25.49	

**Table 6. Means of the mineral elements of the flesh and the seeds of the 11 date palm cultivars**

Mineral elements	Flesh	Seed
N %	0.59	0.96
P %	0.070	0.098
K %	1.20	0.44
Ca %	0.274	0.125
Mg %	0.147	0.064
Cl %	0.583	0.511
Fe ppm	215.45	432.74
Zn ppm	33.36	33.19
Cu ppm	4.12	8.64

These results are in agreement with those found by El-Shurafa *et al.* (1982) working on the mineral content of six Libyan date palm cultivars. However, the values of Fe were higher than those reported by El-Shurafa *et al.* (1982).

The results of the foregoing analysis revealed that dates are rich in some macro-and micro-elements, which justified their utilization as a good source for certain elements in Human nutrition. In addition, seeds are found to be also rich in some mineral elements. Therefore, they can be used for feeding livestock as in the case in Saudi Arabia.

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## التحليل الكيماوي لثمار بعض أصناف التمور السعودية مع التركيز على محتوياتها من العناصر المعدنية

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باشه

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قدرت المكونات الكيميائية لثمار ١١ صنفاً من أصناف التمور المزروعة بمنطقة الرياض وذلك خلال موسم ١٩٨٣. وقد أوضحت النتائج المتحصل عليها أن معظم المكونات الكيميائية التي قدرت (الرطوبة، المواد الصلبة الذائبة الكلية، الحموضة، البروتين والدهون) سواء في لحم الثمار، أو في البذور كانت تختلف من صنف إلى آخر، كما أوضحت هذه الدراسة أيضاً أن النسبة المثوية للرماد تراوحت من ١,٨٠ - ٢,٩٦٪ في لحم الثمار، ومن ٠,٩٩ - ١,٣٨٪ في البذور، وذلك في الأصناف المختلفة. وقد اختلفت كذلك المحتويات المعدنية في كل من اللحم والبذور من صنف إلى آخر، وكان عنصرى النيتروجين والبوتاسيوم من أكثر العناصر وجوداً في كل من لحم الثمار والبذور بمقارنتها بالعناصر المعدنية الأخرى التي درست، واتضح أيضاً من هذه الدراسة أن ثمار أصناف التمور المختلفة تعتبر من المصادر الجيدة للعناصر المعدنية.