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## Chemical Composition of Some Date-Palm Seeds

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The seeds of four cultivars of date palm (*Phoenix dactylifera* L.) cv. Khedhri, Sekkeri, Nabt-Saif and Menifi were chemically analysed for their content of some inorganic and organic compounds. Inorganic ions of K, P, Na, Ca, Mg, Fe, Zn, and Cu were found in these seeds in different quantities according to cultivar except Ca, Mn and Zn where the seeds had similar amounts of them. No organic acids could be detected and ether-extractable substances ranged from 1.18% to 3.07% dry weight. Total-N, crude protein and fibre percentage were different but Menifi seeds contained significant amount of total carbohydrates ( $674.25 \pm 21.04$  mg/g dwt). These seeds contained fructose,  $\alpha$ - and  $\beta$ -glucose and sucrose as their soluble sugars.

Date palm tree is widely cultivated in Saudi Arabia. The fruit is of great importance as a source of food. Developing it by setting up new plants for processing is a fact in Saudi Arabia and hence a by-product of this process is expected and unavoidable. In the past, date seeds were utilized by farmers and villagers in Saudi Arabia as a complementary part of the cattle diet. Little information is known in the literature about the chemical composition of the date seeds except some analysis of khalas cultivar seeds by Hussain and Elzeid (1975). So, it is the objective of this study to report the chemical composition of the seeds of four date palm cultivars grown in Saudi Arabia (Khedhri, Sekkeri, Nabt-Saif, and Menifi). The results could be used to evaluate the nutritive value of these seeds.

### Materials and Method

The seeds of four cultivars of date palm (*Phoenix dactylifera* L.) namely Khedhri, Sekkeri, Nabt-Saif, and Menifi were obtained from local market of 1980 crop for

Sekkeri and 1982 crop for the rest. Seeds were washed thoroughly and then air dried. Water content of the seeds was determined after drying at 105 °C until constant weight was obtained.

For inorganic analysis, samples were acid digested with concentrated HNO<sub>3</sub> on hot plate. Potassium was determined by flame emission while Na, Ca, Fe, Mg, Mn, Zn, and Cu were determined by absorption flame spectrophotometer (pye unicum sp9 equipped with sp9 computer). Ashing method was compared with acid digestion but the latter was found to give repeatable results. Phosphorus was determined colourmetrically according to the method described by Watanabe and Olsen (1965).

Organic analysis was performed with crushed samples because of the difficulty of getting the samples into powder, hence the soluble sugars were identified qualitatively. Moreover, crude fat might be underestimated although repeated runs gave the same results. Crude fat (as petroleum ether soluble fraction) and fibre were estimated according to the methods of A.O.A.C. (1970). Total-N was determined colourimetrically by the method of Allen and Whitefield (1965) and the crude protein as total-N × 6.25. Total sugars were determined by Somogyi method (1952) after hydrolysis of crushed samples by 1N HCl and neutralization by sodium carbonate. Soluble sugars were determined on the neutral fraction by the same method and further identification of the sugars by gas liquid chromatography (GLC) as reported earlier (Basalah *et al.* 1984) after extraction by 80% ethanol and fractionation.

Statistical analysis was performed as described for the one-way analysis of variance by Steel and Torrie (1960) and when the F-value was significant, Duncun's New Multiple-Range Test was used to compare each cultivar content mean with every other cultivar content mean.

## Results and Discussion

Water content of the seeds of the four cultivars is presented in Fig. 1 where the water content of Menifi cultivar was highly significant when compared with the other cultivars. However, the water content of Khedhri and Nabt-Saif was not statistically different but they had a high significant water content from that of Sekkeri. These results suggest that the ionic content of the seeds should be reported on a specified dry weight and not the air dry weight basis, so that comparison of chemical composition of the seeds is justified.

Table 1 shows the ionic content of the four cultivars. These ions are K, P, Na, Ca, Mg, Fe, Zn, Mn, and Cu. It is clear that the cultivars were not different in their Ca, Mn, and Zn content but had different amounts of the other ions. For example,

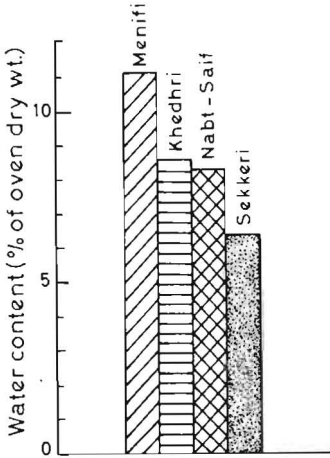


Fig. 1. Water content percentage of the seeds of four cultivars of data palm.

the chemical analysis of K content did not differ in the seeds of the four cultivars except that of Sekkeri which was significantly higher than the others. Phosphorus content was significantly different in all cultivars ranking in this order: Nabt-Saif, Menifi, Khedhri, Sekkeri as shown in Table 1. On the other hand, Sekkeri as well as Menifi seeds had a significantly lower Na content than the other two cultivars. The rest of variations in ionic content for other ions could be easily perceived from the table. These differences in ionic content of the seeds might be ascribed in part to cultivar differences as was suggested for this species earlier (Al-Whaibi, 1983) and other species (Walker *et al.* 1979). Nevertheless, the availability of these ions from the soil where the trees that produced these seeds were grown could be another factor in the apparent variations of the ionic content of these cultivar seeds. However,

Table 1. Ionic content (Mean  $\pm$  SD) of four cultivars of data palm seeds ( $\mu$ MNole/g oven dry wt.)

Ion cultivar	K*	P	Na	Ca	Mg	Fe	Zn	Mn	Cn
Khedhri	83.13 b $\pm 4.75$	28.37 c $\pm 0.01$	12.85 a $\pm 1.94$	7.00 a $\pm 0.83$	5.65 b $\pm 0.47$	0.31 a $\pm 0.03$	0.36 a $\pm 0.03$	0.022 a $\pm 0.008$	0.013 c $\pm 0.001$
Sekkeri	93.20 a $\pm 3.28$	27.17 d $\pm 0.39$	5.62 b $\pm 1.32$	5.88 a $\pm 2.39$	4.11 c $\pm 0.63$	0.23 b $\pm 0.05$	0.33 a $\pm 0.04$	0.021 a $\pm 0.004$	0.015 b $\pm 0.002$
Nabt-Saif	84.18 b $\pm 3.47$	34.69 a $\pm 0.13$	10.24 a $\pm 2.31$	8.09 a $\pm 1.03$	7.08 a $\pm 1.19$	0.38 a $\pm 0.07$	0.33 a $\pm 0.09$	0.027 a $\pm 0.006$	0.019 a $\pm 0.001$
Menifi	78.37 b $\pm 4.11$	29.96 b $\pm 0.07$	7.69 b $\pm 1.39$	6.61 b $\pm 1.48$	4.90 b $\pm 0.72$	0.25 b $\pm 0.02$	0.30 a $\pm 0.01$	0.024 a $\pm 0.007$	0.015 b $\pm 0.001$

\* Ionic contents within the column having common letter do not differ significantly at 99% probability level.

Khalas seeds content of Ca, P, Fe have been reported to be 183, 165 and 8 mg/100 g respectively (Hussein and Elzeid 1975). Recalculation of the results in this study indicated higher values for those ions. Khedhri, Sekkeri, Nabt-Saif, and Menifi seeds contained 280, 235, 324 and 264 mg/100 g of Ca ion respectively. Phosphorus content was 876, 839, 1071 and 925 mg/100 g in the same order while Fe was 17, 12, 21 and 13 mg/100 g of the seeds. Some of these values are relatively close to those reported for Khalas seeds but others are different, possibly due to cultivar differences.

Analysis of some organic materials in the seeds indicated that organic acids could not be detected by paper chromatography but for some other organic materials, the results are shown in Table 2. Percentage of ether extractable materials (mainly crude fat) was generally low but Sekkeri seeds seemed to have the lowest percentage (about 1.18% oven dry) of all the four cultivars. The value of 8.7% crude fat for Khalas seeds reported earlier by Hussein and Elzeid (1975) could not be obtained in this study and no explanation for this discrepancy could be suggested. The seeds of Sekkeri showed also lower content of total-N, crude protein but the total carbohydrates and fibre percentage were higher than those of other cultivars. On the other hand, Menifi seeds contained highly significant amount of crude protein while Khedhri and Nabt-Saif seeds contained almost the same amounts of ether extractable substances, total-N, crude proteins and total carbohydrates. However, these two cultivars differ in their fibre percentage as the seeds of Nabt-Saif showed lower percentage than that of Khedhri. Similar results of fibre percentage of Nabt-Saif were reported by Hussein and Elzeid (1975) for Khalas seeds. However, total carbohydrates of these cultivars seem to be higher than that of Khalas seeds as the recalculation of the results indicated that the seeds of the cultivars under study contained more than 60% of the dry weight while Khalas seeds had 44.2% dry weight as reported by those authors. However qualitative identification of soluble sugars by GLC indicated that all the seeds of the four cultivars contained fructose,

Table 2. Organic analysis of the seeds of four date palm cultivars (Mean  $\pm$  SD)

Cultivar	Ether extract % dwt.	Total-N* $\mu$ Mole/g dwt.	Crude protein (Nx 6.25) $\mu$ g/g dwt.	Total carbohydrate mg/g dwt.	Fibre % dry wt.
Khedhri	2.01	0.52 $\pm$ 0.01 ab	45.20 $\pm$ 0.42 b	589.16 $\pm$ 50.65 b	20.71
Sekkeri	1.18	0.42 $\pm$ 0.01 b	36.58 $\pm$ 0.30 c	674.25 $\pm$ 21.04 a	21.34
Nabt-Saif	2.13	0.54 $\pm$ 0.02 ab	47.23 $\pm$ 02.9 b	566.53 $\pm$ 20.43 b	16.62
Menifi	3.07	0.59 $\pm$ 0.05 a	54.11 $\pm$ 1.70 a	512.06 $\pm$ 57.53 b	20.39

\* Values within the column followed by a common letter do not differ significantly at 99% probability level.

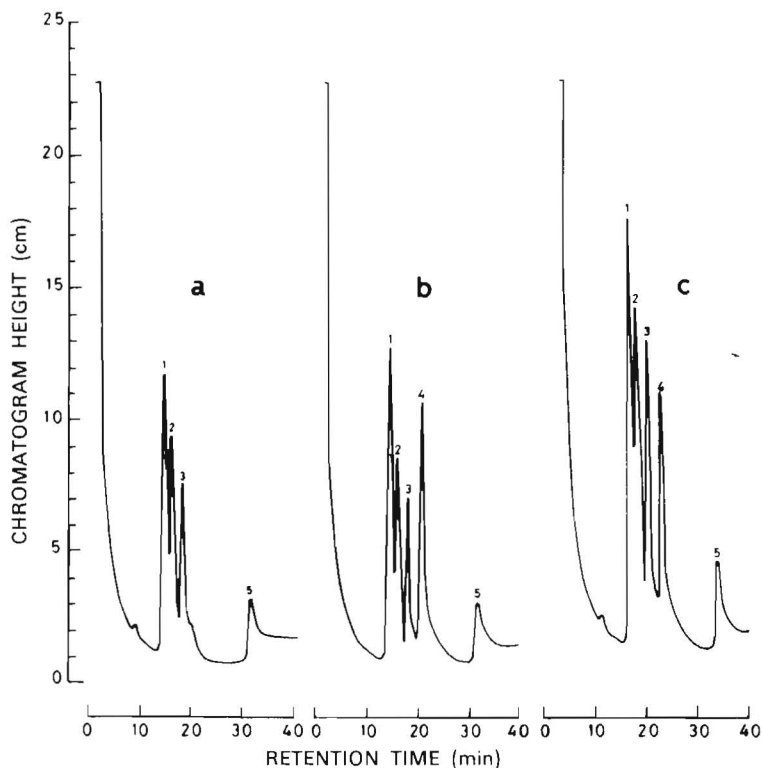


Fig. 2. An example chromatogram of TMS derivative of soluble carbohydrates extracted from date seeds (Menifi) where (a) seed extract, (b) marker carbohydrates (1 = fructose, 2 =  $\alpha$ -glucose 3- $\beta$ -glucose, 4 = Inositol, 5 = sucrose) and (c) seed extract + marker. For instrument conditions see reference (4).

$\alpha$ -glucose,  $\beta$ -glucose and sucrose as shown in Fig. 2. Qualitative as well as quantitative analysis of amino acids and some other chemical constituents of those seeds is underway.

In general, these results reflect the cultivar differences and furnish some basic information about the nutritive value of those seeds for livestock.

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## التركيب الكيميائي لبذور بعض أصناف النخيل

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تم تحليل بذور أربعة أصناف من نخيل البلح (خضرى وسكرى ونبت سيف ومنيفي) حيث وجد ان بذور هذه الاصناف لا تختلف في محتواها الأيوني من الكالسيوم والمنجنيز والزنك ، اما الايونات الاخرى (البوتاسيوم ، الفسفور ، المغنيسيوم ، الحديد والنحاس) فالاختلافات ذات دلالة معنوية . اما الاحماض العضوية فقليلة ولا يمكن فصلها بالتحليل اللوني الورقي ، وقد تراوحت كمية الدهون من ٨,١٪ الى ٣,٠٧٪ من الوزن الجاف . وبالنسبة للمحتوى النيتروجيني والبروتينات والألياف فقد اختلفت في جميع الاصناف تحت الدراسة . وقد دلت الدراسة على ان صنف السكرى يحتوى على اكبر كمية من المواد الكربوهيدراتية حيث بلغت ٦٧٤,٢٥ ± ٢١,٠٤ مليجرام/ جرام وزن جاف الا ان جميع الاصناف يوجد بها فركتوز والفا و بيتا جلوكوز وسكروز كسكريات ذائبة .