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**ORGANIC AND INORGANIC CONSTITUENTS
OF DATE PALM PIT (SEED)**

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ABSTRACT

The organic and inorganic constituents were determined in seeds (pits) of six leading southern Libyan date cultivars: namely Taleese, Adwi, Taghiat, TASFERT, ASPEAR and SELLOULOU. The averages of different constituents (on dry weight basis) of all cultivars were as follows: starch 20.64%, reducing sugars 2.4%, non-reducing sugars 1.98%, protein 6.43%, oil 9.2%, ash 1.20%, Ca 0.038%, K 0.244%, P 0.112%, Na 0.0082%, Cl 0.161%, Fe 30.4 ppm, Mn 15.7 ppm, Zn 28.84 ppm, and Cu 8.1 ppm. The chemical characteristics of oil were as follows: Iodine number 54.8, saponification value 207.3 and acid value 1.75. Reducing sugars, starch, total carbohydrates, protein, oil, ash, K, P, Cl, Mn and Zn were significantly different among cultivars, whereas non-reducing sugars, total sugars, Ca, Na, Fe and Cu did not show significant differences due to cultivars.

المكونات العضوية والمعدنية لبذرة نخلة التمر

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الخلاصة:

تم تقدير المكونات العضوية والمعدنية في بذور ستة أصناف رئيسية من تمر

جنوب ليبيا، هي:

تاليس، اضوي، تاغيات، تاسفرت، اسبير، سلولو.

وقد وجد أن متوسط محتوى بذور الاصناف المذكورة من المكونات التي تم تقديرها كما يلي (على اساس الوزن الجاف):

- النشا	20,64%	- الزنك (الخارصين)	28.84	جزء في المليون
- السكريات غير المختزلة	1,98%	- السكريات المختزلة	2,46%	
- الدهون	9,2%	- البروتين	6,43%	
- الكالسيوم	0,038%	- الرماد	1,20%	
- الفسفور	0,112%	- البوتاسيوم	0,244%	
- الكلوريد	0,161%	- الصوديوم	0,0082%	
- المنجنيز	15,71	- النحاس	8,1	جزء في المليون
- الحديد	30,4			جزء في المليون

أما مواصفات الدهون فقد كانت كما يلي:

الرقم اليودي 54,8 ، رقم التصبن 207,3 ، الرقم الحمضي 1,75 وقد وجدت فروق احصائية بين الأصناف في محتوى بذورها من:

السكريات المختزلة، النشا، الكربوهيدرات الكلية، البروتين، الدهون، الرماد، البوتاسيوم، الفسفور، الكلور، المنجنيز، الزنك، بينما لم توجد فروق احصائية بين الأصناف في حالة كل من السكريات غير المختزلة، السكريات الكلية، الكالسيوم، الصوديوم، الحديد، والنحاس.

INTRODUCTION

Pit of date palm (seed) is a waste product of many industries based on flesh of date fruit such as date syrup (known as Dibis, in Libya as Rub-altamar), dry invert sugar, yeast, alcohol, vinegar, citric acid and different sweets (9). Although the pits are about 13% of the total weight of date fruit (4), no serious attempts were made to make good use of these as potential by-products. In some date producing countries, pits are used as fodder for domestic farm animals. Little work has been published earlier on chemical

composition of date palm seed (1, 3, 7-8).

The objective of this study was to determine the sugars, starch, protein, oil and oil characters, and minerals in pits of six leading date cultivars of southern Libya. This might be helpful in producing fodder for ruminants, and other domestic animals, in addition to the use of some of these components for industrial purposes.

MATERIALS AND METHODS

Pits of major date cultivars of southern Libya were used in the present study; namely Taleese, Adwi, Taghiat, TASFERT, Aspear and Seloulou. Fruit samples of about 20 orchards were collected in October, 1978 at tamar stage from three major date growing districts in southern Libya (Sebha, Ubari, and El-Shatie). Fifty fruits from each sample were taken and deseeded. The pits of each cultivar, in each district, were combined to make a composite sample and used as a replicate. The pits were dried in a draft oven at 65°C to a constant weight and ground for chemical analysis.

Minerals:

Two grams of the ground samples were digested with HCl (dry ashing) according to Chapman and Pratt (2). Analysis for K, Ca, and Na was by flame photometer, Zn and Cu by atomic absorption, P, Mn and Fe by spectrophotometer and Cl by titration with silver nitrate (2).

Carbohydrates:

Three grams of the ground material were used for sugar extraction using 80% ethanol. The non-reducing sugars were determined by hydrolysing a part of the sugar extract with 1 N HCl for 10 minutes on a water bath at 67°C (3). Starch was determined in the dried alcohol insoluble residue after hydrolysing with 1 N HCl for 4 hours on a water bath at 90°C (6). The reducing power of reducing and non-reducing sugars and starch after hydrolysis, was determined by Somogyi micro-copper reagent method (11). The non-reducing sugars were taken as the difference between the reducing sugars before and after acid hydrolysis.

Oil:

Ten grams of dried pits were used for oil extraction with petroleum ether in a Soxhlet apparatus for 8 hours. Iodine value, saponification value, and acid value were determined according to Pearson (10) in a composite sample for the three districts.

Protein:

Total nitrogen was determined by the micro-Kjeldahl method. Protein was calculated using the general factor (6.25).

Data are expressed as percent of dry weight except for Fe, Mn, Zn and Cu which are expressed as ppm.

RESULTS AND DISCUSSION

Carbohydrates: Carbohydrate contents of pits represented about 25% of their total dry weight (Table 1). Starch was the dominant form of carbohydrate in the pits. The starch: total sugars ratio was about 5:1. The pits of Taghiat contained the highest percentage of carbohydrates (26.86%), while pits of Aspear contained the lowest percentage (24.24%). Other cultivars were intermediate. Pits of all cultivars contained much lower quantities of sugars (about 4.5%) as compared to their flesh which contained about 69.03% (Table 3). Tafert pits contained higher amounts of reducing sugars than other cultivars. This was statistically significant. Non-reducing sugars and total sugars were not significantly different. The amount of sugars and starch obtained in the present study were generally similar to those reported for pits of Khalas (8).

Oil and Oil Characteristics: Appreciable amounts of oil were found in the pits (Table 1). Oil content ranged from 8.7% for Taleese to 10.0% for Adwi. Values obtained were generally similar to those cited by Dowson and Aten (3) and Hussein and El-Zeid (8), but higher than those reported by Al-Talikhani et al (1). Iodine value ranged from 48.32 for Aspear to 66.28 for Taleese. These values were lower than those for olive oil, almond oil, sesame oil, soya oil and sunflower oil (10). In other words, the degree of saturation of date palm oil was less than that of these oils. The

saponification values ranged from 201.03 for Seloulou to 224.40 for Adwi. These values were within ranges reported for date palm pits (1,3) and olive oil (10). The acid value and free fatty acids obtained for the cultivars studied were slightly higher than those reported earlier (1, 3).

Protein: Date palm pits contained considerable amounts of protein (Table 1). Pits of Seloulou were the highest (7.68%) while pits of Adwi were the lowest (4.46%). These results were in general agreement with those reported by Dowson and Aten (3) and Furr and Cook (7), but higher than those of Hussein and El-Zeid(8).

Inorganic Constituents:

Ash: The percentage of ash in the pits varied with cultivars; it was the highest in Taghiat pits (1.43%) and the lowest in Adwi pits (1.03%) (Table 2). Values obtained were similar to those cited by Dowson and Aten (3), but were much lower than those reported by Hussein and El-Zeid (8).

Minerals: The mineral contents of pits of all cultivars are presented in Table 2. Amounts of K in the pits were found in excess of any other element determined in this study and it was over 29 times of Na. Potassium, P, Cl, Mn and Zn contents were significantly different in cultivars, whereas Ca, Na, Fe and Cu did not show significant differences among cultivars.

Pit/Flesh: In the previous studies (4,5), the different constituents of the flesh of these cultivars were determined. It seems worthwhile to compare organic and inorganic constituents of pits with those of flesh. The pits were found to contain higher percentage contents of oil, protein, P, Fe, Mn and Cu and lower contents of total sugars, ash, Ca, K, Na, Cl and Zn than the flesh (Table 3).

Table 1
Organic Constituents of Pits of Six Leading Date

Cultivars	Carbohydrates				
	Reducing Sugars %	Non-Red- ucing Sugars%	Total Sugars %	Starch %	Total Carbo- hydrates %
Taleese	2.25b	1.25a	2.77a	20.38abc	24.48b
Adwi	2.00b	2.27a	4.27a	21.50ab	25.77ab
Taghiat	2.21b	2.57a	4.78a	22.02a	26.86a
Tasfert	3.37a	1.85a	5.20a	20.07bc	25.27ab
Aspear	2.47b	1.81a	4.61a	19.63c	24.24b
Seloulou	2.43b	1.88a	4.35a	20.22bc	24.59b
Mean	2.46	1.98	4.50	20.64	25.14

Means in a column followed by the same letter are not significantly

Cultivars Grown in Southern Libya (On Dry Weight Basis)

Oil and Oil Characters

Protein (Nx6.25) %	Oil %	Iodine number	Saponi- fication Value	Acid Value mg/KOH/g.oil	Free Fatty Acid Expressed as Oleic Acid
5.96ab	8.70b	66.28	204.0	1.41	2.81
4.46b	10.00a	52.35	224.4	1.53	3.06
6.55ab	9.38ab	50.14	208.2	2.04	4.08
7.33a	9.21ab	61.96	203.4	1.87	2.74
6.33ab	9.21ab	48.32	202.7	1.68	2.36
7.64a	8.7b	49.76	201.1	1.96	2.92
6.43	9.20	54.80	207.3	1.75	3.50

different at P=0.05 according to Duncan's multiple range test.

Table 2
Inorganic Constituents of Pits of Six Leading Date Cultivars

Cultivars	Concentration				
	Ash %	Ca %	K %	P %	Na %
Taleese	1.18ab	0.050a	0.237ab	0.128a	0.0089a
Adwi	1.03b	0.038a	0.221ab	0.0915b	0.0069a
Taghiat	1.43a	0.037a	0.217b	0.112ab	0.0088a
Tasfert	1.15ab	0.042a	0.297a	0.116ab	0.0085
Aspear	1.12ab	0.029a	0.023ab	0.109ab	0.0076a
Seloulou	1.30ab	0.033a	0.268ab	0.114ab	0.0084a
Average	1.203	0.038	0.244	0.112	0.0082

Means in each column followed by the same letter are not significantly

Table 3
The Ratio of Organic and Inorganic Constituents

Constituents*	Reducing	Non-Red-	Total	Protein	Oil	Ash	Ca
	Sugars	ucing	Sugars				
	%	%	%	%	%	%	%
Pit	2.46	1.98	4.50	6.43	9.2	1.203	0.038
Flesh	66.13	3.00	69.03	1.98	0.067	2.583	0.058
Pit/Flesh	0.037	0.66	0.065	3.25	137.3	0.47	0.66

* Average for all cultivars

Grown in Southern Libya (On dry Weight Basis)

Cl %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
0.122c	35.2a	19.4a	26.5ab	7.41a
0.228a	24.4a	18.0a	32.8a	8.51a
0.151abc	34.7a	18.3a	27.2ab	7.94a
0.154abc	35.1a	14.0ab	30.7ab	8.54a
0.130abc	27.1a	9.7b	24.4b	7.41a
0.184a	25.5a	14.8ab	31.4ab	8.52
0.161	30.4	15.7	28.84	8.10

different at $P = 0.05$ according to Duncan's multiple range test.

Between Pits and Flesh (4,5).

K %	P %	Na %	Cl %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
0.244	0.112	0.008	0.161	30.4	15.7	28.8	8.05
0.703	0.059	0.011	0.468	28.4	8.1	57	5.1
0.35	1.9	0.75	0.34	1.07	1.9	0.51	1.5

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