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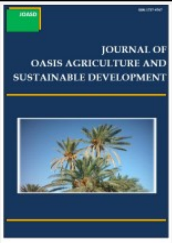

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Mineral fruit composition variation alongside *Phoenix dactylifera* L. cultivars dependently on geographical origin and agronomic traits.

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Abstract

Date palm gives fruits that make a significant human dietetic through great amounts of different sugars supplement and of minerals. Water, ash and six minerals contents were investigated in dates of 131 individual trees. The geographical effect in mineral content was carried out on tow cultivars, Deglet nour and Alig. New oases of Jerid region, compared to other origins, gave date of Deglet nour with the highest levels of the studied parameters except for the ash and the Calcium contents which were stable between oases. However, old oasis of Jerid region had fruit Alig with the upper levels in phosphorus (0.1 g/100g), sodium (54.76 ppm), magnesium (0.05 g/100g) and iron (0.77 mg/100g); but the lowest in total mineral content (1.75 g/100g) and manganese (0.14 mg/100g). The effect of agronomic traits (maturity period and fruit consistency) was studied basing on 38 different cultivars. Concerning the maturity period, fruits of early ripening cultivars exhibited an elevated concentration in iron (0.87 mg/100g) and calcium (0.024 g/100g) in comparison with those of later maturity cultivars which had the highest ash percent (1.59 g/100g). For the fruit consistency, soft fruits showed the greater Iron content (0.84 mg/100g) but the dry ones exhibited the highest potassium content (0.57 g/100g). These results proposed to consumers that they have to consider the provenance, the fruit consistency and the maturity period which looks as a good indicator for mineral content.

1. INTRODUCTION

Date palm (*Phoenix dactylifera* L.), belongs to the Arecacea family; and is native to geographical zones with arid and semi-arid climates (Munier, 1973). It is intensively cultivated in the Middle East and in the North of Africa (Munier, 1973). This culture is known in these areas from pre-historic time and had been mentioned in several civilizations as an important human food (Elbekr, 1972).

Nowadays, these tree-plants are of great economical and social values (Elshibli and Korpelainen, 2009). In Tunisia, the date palm culture is widespread on 32000 ha of oases and represents more than 4 million trees (G.I.F., 2011). Annually, over than 160000 tons of dates are produced. By exporting more than 60000 tons of dates, with a value of 140 million US dollars, Tunisia did occupy the 4th world classified dates-exporter and the first place within revenue values (G.I.F., 2011).

In regard to this great importance, dates quality supervising was an essential objective in order to ameliorate their production. Date quality is highly affected by environmental (water availability, soils, pests, etc) and by intrinsic factors resulting from its important genetic diversity which is projected on fruit qualities. More than 200 cultivars have been noticed and described in Tunisia (Rhouma, 2005, Ferchichi and Hamza, 2008) and each cultivar name is inspired from its fruit characteristics. These cultivars presented differences in ripening time. So, three different classes of date palm cultivars are identified dependently on their fruit maturation period: Early, Mid-Season and Late. Moreover, fruit consistency is the most important parameter that usually determines the qualities of fruits and their commercial interest. Formerly, this trait segregates three different classes of date: Soft, Semi-dry and Dry (Munier, 1973). Actually, semi-dry fruits cultivars heterogeneity was proved. Because of that, they have been divided into two new clusters: semi-soft and semi-dry with approved morphological and genetic distinction (Hamza et al., 2009, 2011).

Biochemical analyses showed that dates contain various reducing and non-reducing sugars, glucose, fructose and sucrose; and in lesser amounts cellulose and starch. In the same cultivar and during the fruit ripening, the water and sugar contents changes continuously (Mustafa et al., 1986, Barreveled, 1993). Inorganic elements contents of the date pulp have been investigated and many mineral salts were underscored. The highest macro- and microelement amounts were found to be for potassium (K) and iron (Fe), respectively (Hass, 1935).

Determination of the ash and mineral content in foods is important for a number of reasons such as: nutritional labeling, quality, microbiological stability, nutrition and processing (McClements, 2003). In *Phoenix dactylifera* L., mineral composition varies widely among cultivars and is closely related to farming and climate conditions (Hasnaoui et al., 2011). Therefore, we had projected to analyze its variability in relationship two various parameters: (i) extrinsic factors: the geographical origin; and (ii) intrinsic traits: fruits consistency and period of maturation. This study is devoted to delineate the importance of dates as a mineral dietetic supply and the variation of this interest within the upper-indicated parameters.

2. MATERIAL AND METHODS

2.1. Sites of material collection

Date palm fruits were collected from cultivars at Tamer stage, when they were fully ripened. These cultivars are belonging to the continental Tunisian oases (Fig 1.) which represent more than 85% of the total date palm oases of Tunisia. Analyses were performed on 131 individual trees belonging to 38 cultivars (Table 1). They were chosen due to the commercial importance of their fruits (Ferchichi and Hamza, 2008).

Mineral analyses

The water content was determined by drying 2 g of pulp: the sample is spread over a stainless steel capsule, and then dried in a vacuum oven at a temperature 70 °C for 48 hours (Booij et al., 1992).

About 5g of dried pulp of each cultivar was ignited and ashed in a porcelain capsule in the Muffle furnace (Heraeus Electronic) at about 550 °C for 7 hours. The percentage of the total ash was calculated after the ignition. The ash was dissolved in 5ml conc. HCl and 5ml of ultrapure water, at boiling point the solution was filtered twice from impurities and transferred quantitatively into 100ml volumetric flask using ultrapure water.

Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Iron (Fe) and Manganese (Mn) contents present of each cultivar were analyzed separately using an AA-6300 atomic absorption spectrometer (Shimadzu). The total Phosphorus (P) was determined by spectrophotometer (Secomam 1000, French).

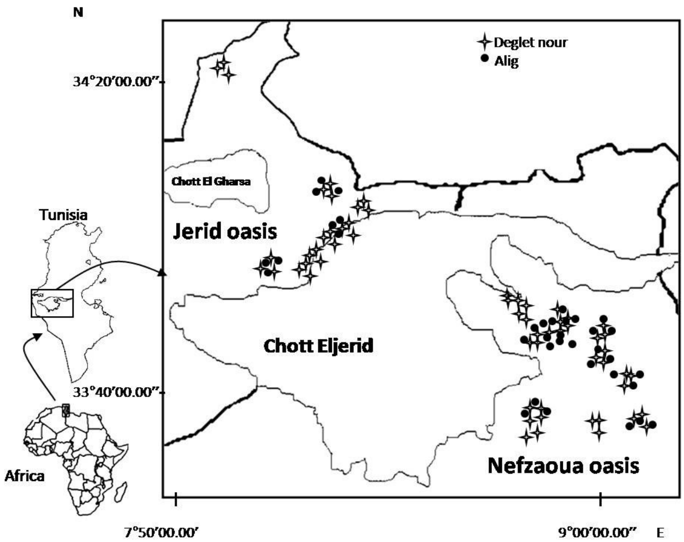

Fig 1. Sites of collected date palm fruit samples.

2.2. Provenance effect

The effect of population geographical origin on mineral composition was studied basing on two cultivars: Deglet nour and Alig, the most common in both Nefzaoua and Jerid oases (Hamza et al., 2006). The first cultivar is considered as the most sensitive to abiotic constraints, while the Alig one is more resistant (Rhouma et al., 2006). For each cultivar, many localities (60 for Deglet nour and 33 for Alig), belonging to Nefzaoua and Jerid oases, were investigated and their distribution is shown in the figure. These localities are also divided into two main groups, according to their antiquities, then we distinguish new oases (age < 20 years) and old ones (age > 20 years).

2.3. Fruit consistency and maturity period effect

The studied cultivars were clustered into groups based on fruit quality and maturity period. Three groups were distinguished according to maturity period: early season (10 cultivars), mid-season (12 cultivars) and late season (16 cultivars). Based on fruit consistency (texture) the same cultivars are also clustered into four groups: soft (18 cultivars), semi-soft (6 cultivars), semi-dry (8 cultivars) and dry (6 cultivars). All fruits were collected from old oases of Jerid and/or Nefzaoua.

2.4. Data analysis

The impact of geographical or fruit qualities in mineral content were analysed separately by ANOVA with post-hoc LSD mean comparisons and the statistical program was SPSS 12.0 (SPSS 2003).

3. RESULTS

3.1. Water content

Water content of the pulp of the date was found to be in the range of 16.46% and 47% respectively for Kintichi and Ammary cultivars (Table 2). Deglet nour cultivars of new Jerid oases contained high amounts of water in fruit pulps, than the other areas (Table 3). In the case of Alig cultivar, significant variation was observed in the water content within geographical distribution. Fruit Alig from the old Jerid oases had the lowest moisture content. Table 4 shows that the maturity period and the fruit consistency significantly had influenced the pulp's water content. So, cultivars with early maturating or soft fruits conserved the higher percent of water respectively of 36.02% and 33.92%. Latest fruit-maturing cultivars presented the lowest values of water content (23.22%).

3.2. Ash

The percentage of ash in the dry matter of pulp varied among cultivar. The highest value was for Kintichi cultivar (3.97% of the dry matter) and the lowest was for Choddakh cultivar (0.79% of the dry matter) (Table 2). There was no significant geographical effect on Ash percentage in the case of Deglet nour cultivar (Table 3). However, Alig in the new oases of Jerid had the highest ash percentage when compared with the other localities. The old Jerid oases showed the lowest ash value (Table 3). The maturity period showed a significant effect on the ash percentage in the dry matter. The later maturity cultivars had the highest values (1.59 g/100g of flesh material) in comparison to other groups. However, fruit consistency did not show any significant effects on ash percent despite the higher percent for the dry fruits (1.66 g/100g) (Table 4).

Table 1. Name, origin and main fruit characteristics (at Tamer Stage) of date-palm cultivars studied.

Cultivars	Origin	Consistency	Maturity
Alig	N, J	Semi-dry	Late
Ammary	N, J	Soft	Early
Arichty	N, J	Semi-dry	Late
Bejjou	N, J	Dry	Late
Bidh Hmam	N, J	Soft	Mid-season
Bissr Helou	N, J	Dry	Mid-season
Bou faggouss	J	Soft	Late
Bou merzoug	J	Soft	Mid-season
Choddakh	N, J	Semi-soft	Mid-season
Choddakh Ben Jbir	N	Semi-soft	Mid-season
Degla Bidha	J	Dry	Late
Deglet Nour	N, J	Semi-soft	Late
Dhahbi	J	Semi-soft	Late
Fermla	N	Semi-dry	Mid-season
Fezzani	N, J	Semi-dry	Mid-season
Ghars souf	N, J	Soft	Mid-season
Gondi	N, J	Semi-soft	Mid-season
Gosbi	N, J	Soft	Early
Hamra	N, J	Semi-dry	Mid-season
Hissa	N, J	Soft	Early
Hlwa	N	Semi-dry	Late
Horra	N, J	Dry	Mid-season
Kenta	N, J	Dry	Late
Kintichi	J	Dry	Late
Ksebba	J	Semi-dry	Late
Lagou	N, J	Soft	Early
Loghrabi	J	Semi-soft	Mid-season
Mahmoudya	J	Soft	Mid-season
Malti	N, J	Soft	Early
Om essayed	N, J	Soft	Early
Om Leghlez	J	Soft	Early
Rotbayet Jaddi	N	Soft	Early
Rotbayet yagouta	N	Soft	Early
Rtob Houdh	J, N	Soft	Mid-season
Rtotbayet	N	Soft	Mid-season
Tezerzayet Kahla	N, J	Soft	Mid-season
Tezerzayet Safra	J	Soft	Early
Tronja	N, J	Semi-dry	Late

(N: Nefzaoua, J: Jerid)

3.3. Minerals content

The potassium (K) was the element with the greater percentage and the smaller was for the manganese (Mn). The over-all mean values of the studied cultivars were 0.51g/100g for the potassium (K) and 0.19 mg/100g for the manganese (Mn) (Table 2). In exception of calcium (Ca) which did not change within geographical distribution, all mineral elements of the Deglet nour fruits collected from new Jerid oases exceeded that of the fruit from other oases. The phosphorus (P), sodium (Na), Magnesium (Mg) and iron (Fe) pulp contents were greater in

Table 2. Water percent of fresh matter, ash and mineral contents of dry matter (pulp) of the studied cultivars collected from the old oases.

Nom	Water (%)	MM (g/100g)	P (g/100g)	Na (ppm)	K (g/100g)	Ca (g/100g)	Mg (g/100g)	Fe (mg/100g)	Mn (mg/100g)
Alig	20.78	2.98	0.09	50.64	0.65	0.02	0.04	0.72	0.17
Ammary	47.00	1.42	0.10	56.98	0.43	0.03	0.05	0.73	0.24
Bejjou	19.50	1.30	0.07	50.86	0.68	0.02	0.04	0.79	0.13
Besser helou	23.83	1.51	0.08	41.32	0.58	0.02	0.03	0.73	0.17
Choddakh	31.00	0.79	0.07	74.08	0.38	0.02	0.03	0.56	0.11
Choddakh ben jbir	30.19	1.20	0.06	81.92	0.55	0.04	0.04	0.74	0.14
Deglet nour	23.64	3.22	0.07	28.35	0.30	0.02	0.02	0.46	0.09
Dhahbi	26.00	0.79	0.08	64.88	0.42	0.01	0.03	0.72	0.12
Fazzani	30.00	0.94	0.07	43.48	0.40	0.02	0.03	0.56	0.20
Fermla	23.00	1.12	0.06	67.78	0.57	0.02	0.03	0.72	0.12
Ghars souf	39.00	1.00	0.09	67.46	0.50	0.02	0.03	0.82	0.26
Gonda	29.00	0.91	0.07	61.62	0.43	0.01	0.03	0.95	0.40
Gosbi	39.88	1.20	0.10	51.84	0.59	0.03	0.05	0.85	0.56
Hamra	26.50	1.31	0.07	80.00	0.63	0.03	0.04	0.78	0.24
Hissa	43.00	1.03	0.09	46.16	0.47	0.03	0.03	1.16	0.24
Hloua	27.00	0.97	0.07	48.46	0.49	0.02	0.04	0.73	0.14
Horra	22.00	0.94	0.06	55.92	0.57	0.02	0.04	0.95	0.11
Kintichi	16.46	3.97	0.10	38.08	0.47	0.02	0.04	0.68	0.20
Loghrabi	26.00	1.20	0.10	50.70	0.61	0.02	0.04	0.64	0.14
Om Leghlez	34.00	0.95	0.06	33.08	0.49	0.02	0.04	0.82	0.12
Rotbayet elmansoura	29.00	0.97	0.08	62.26	0.51	0.02	0.03	0.80	0.18
Rotbayet yagouta	34.00	0.93	0.08	79.24	0.57	0.02	0.03	0.92	0.17
Rtob houdh	42.00	1.07	0.05	49.36	0.60	0.02	0.03	0.63	0.12
Tezerzyet Kahla	30.00	0.84	0.07	39.36	0.39	0.02	0.04	0.89	0.11
Tezerzyet safra	29.00	0.92	0.08	49.40	0.47	0.01	0.03	0.90	0.07
Tronja	20.76	0.80	0.08	78.22	0.41	0.02	0.04	0.90	0.25
Arichty	29.36	0.90	0.08	91.64	0.57	0.01	0.03	0.79	0.14
Bidh Hmam	27.80	0.96	0.07	47.22	0.47	0.02	0.04	0.79	0.15
Bou faggouss	24.08	0.99	0.07	54.28	0.48	0.02	0.04	0.72	0.20
Bou merzoug	33.43	0.87	0.07	45.88	0.43	0.01	0.04	0.96	0.14
Degla Bidha	25.89	1.19	0.09	51.06	0.63	0.02	0.05	0.73	0.25
Kenta	23.16	1.05	0.06	36.82	0.47	0.02	0.03	0.64	0.24
Ksebba	21.72	1.14	0.08	28.68	0.44	0.01	0.03	0.59	0.15
Lagou	26.20	1.19	0.09	36.66	0.47	0.03	0.05	0.67	0.32
Mahmoudya	25.10	1.35	0.09	40.98	0.64	0.02	0.03	0.80	0.17
Malti	45.79	1.06	0.08	43.48	0.44	0.02	0.03	0.89	0.19
Om essayed	18.28	1.05	0.05	51.94	0.46	0.02	0.04	0.94	0.33
Rotbayet Jaddi	43.05	1.12	0.10	71.04	0.64	0.02	0.05	0.86	0.14
Maximum	*47.00*	*3.97*	*0.10*	*91.64*	*0.68*	*0.04*	*0.05*	*1.16*	*0.56*
Minimum	*16.46*	*0.79*	*0.05*	*28.35*	*0.30*	*0.01*	*0.02*	*0.46*	*0.07*
Mean	*29.12*	*1.24*	*0.08*	*53.98*	*0.51*	*0.02*	*0.04*	*0.78*	*0.19*
Standard deviation	*7.84*	*0.67*	*0.01*	*15.65*	*0.09*	*0.01*	*0.01*	*0.14*	*0.09*

Alig fruits collected from old Jerid oases than those from other localities. Conversely, the potassium (K) and the calcium (Ca) have not showed a significant variation. The manganese (Mn), as showed in the case of Deglet nour, is greater in Alig fruit of new Jerid oases. These deductions were confirmed by variance analysis (as illustrated in Table 3).

Concerning the fruit qualities (maturity period and consistency), only the amounts of potassium (K), calcium (Ca) and iron (Fe) were significantly variables (Table 4). According to LSD test, fruits of the cultivars with early maturity had the greater percentage of calcium (Ca) and iron (Fe). For the fruit consistency groups, dry cultivars had the highest potassium (K) content, while the soft ones showed the main iron (Fe) content. The phosphorus (P), the sodium (Na), the Magnesium (Mg) and the manganese (Mn) have not showed a significant variability between fruits qualities groups.

Table 3. Water percent of fresh matter; ash and mineral contents of dry matter (pulp) in term of localization and oases age. (S: The mean difference is significant at the 0.05 level, NS: no significant difference)

	Cultivar	Deglet Nour					Alig				
	Provenances	Nefzaoua		Jerid		LSD	Nefzaoua		Jerid		LSD
	Age	New	Old	New	Old		New	Old	New	Old	
Water (%)	**Mean** **SD**	24.55b ±2.58	23.23b ±3.11	28.45a ±2.88	24.19b ±4.67	S	20.22ab ±0.72	21.70a ±4.61	18.44ab ±0.90	17.56b ±2.39	S
Ash (g/100g)	**Mean** **SD**	3.88 ±1.22	3.23 ±1.22	3.70 ±1.53	3.21 ±1.64	NS	5.12ab ±0.45	3.32ab ±1.80	5.81a ±1.23	1.75b ±0.20	S
P (g/100g)	**Mean** **SD**	0.07b ±0.01	0.07b ±0.02	0.09a ±0.01	0.08ab ±0.02	S	0.05c ±0.00	0.09ab ±0.02	0.07bc ±0.01	0.1a ±0.01	S
Na (ppm)	**Mean** **SD**	37.07ab ±25.64	26.25b ±14.67	47.24a ±4.72	31.14ab ±17.54	S	32.93b ±4.22	49.46a ±14.34	31.89b ±5.50	54.76a ±10.50	S
K (g/100g)	**Mean** **SD**	0.35b ±0.23	0.25b ±0.17	0.56a ±0.04	0.36b ±0.22	S	0.48 ±0.04	0.64 ±0.15	0.52 ±0.10	0.67 ±0.10	NS
Ca (g/100g)	**Mean** **SD**	0.019 ±0.01	0.016 ±0.01	0.018 ±0.00	0.018 ±0.00	NS	0.02 ±0.00	0.02 ±0.01	0.02 ±0.00	0.02 ±0.00	NS
Mg (g/100g)	**Mean** **SD**	0.02ab ±0.01	0.02b ±0.01	0.03a ±0.00	0.03a ±0.01	S	0.02c ±0.00	0.04b ±0.01	0.04b ±0.01	0.05a ±0.00	S
Fe (mg/100g)	**Mean** **SD**	0.62ab ±0.46	0.39c ±0.26	0.89a ±0.25	0.54bc ±0.33	S	0.53b ±0.06	0.70ab ±0.19	0.55ab ±0.10	0.77a ±0.03	S
Mn (mg/100g)	**Mean** **SD**	0.18ab ±0.16	0.08c ±0.05	0.21a ±0.11	0.11c ±0.06	S	0.28a ±0.05	0.18b ±0.06	0.33a ±0.09	0.14b ±0.02	S

Each value in the table is represented as mean ± SD; NS: not significant according to LSD test (p<0.05)

Table 4. Water percent of fresh matter; ash and mineral contents of dry matter (pulp) in term of the maturity period and the consistency of the date. (S: The mean difference is significant at the 0.05 level, NS: no significant difference)

		Maturity period groups				Fruit consistency groups				
		Early	Mid-Season	Late	LSD	Soft	Semi Soft	Semi Dry	Dry	LSD
Water (%)	**Mean** **SD**	36.02a ±9.41	29.24b ±5.41	23.22c ±3.59	S	33.92a ±8.35	27.67b ±2.81	24.89b ±3.79	21.82b ±3.38	S
Ash g/100g	**Mean** **SD**	1.08b ±0.15	1.06b ±0.20	1.59a ±1.09	S	1.05 ±0.15	1.35 ±0.90	1.26 ±0.71	1.66 ±1.15	NS
P g/100g	**Mean** **SD**	0.08 ±0.02	0.07 ±0.01	0.078 ±0.01	NS	0.078 ±0.01	0.075 ±0.01	0.076 ±0.00	0.076 ±0.01	NS
Na ppm	**Mean** **SD**	51.98 ±14.28	56.83 ±14.21	52.03 ±18.74	NS	51.48 ±12.20	60.66 ±18.12	61.11 ±21.57	45.67 ±7.94	NS
K g/100g	**Mean** **SD**	0.50 ±0.07	0.52 ±0.09	0.50 ±0.11	NS	0.50ab ±0.07	0.45b ±0.11	0.51ab ±0.10	0.57a ±0.08	S
Ca g/100g	**Mean** **SD**	0.024a ±0.01	0.021ab ±0.01	0.019b ±0.00	S	0.02 ±0.00	0.02 ±0.01	0.02 ±0.00	0.02 ±0.00	NS
Mg g/100g	**Mean** **SD**	0.04 ±0.01	0.03 ±0.01	0.04 ±0.01	NS	0.04 ±0.01	0.03 ±0.01	0.03 ±0.03	0.04 ±0.01	NS
Fe mg/100g	**Mean** **SD**	0.87a ±0.13	0.77b ±0.13	0.71b ±0.10	S	0.84a ±0.12	0.69b ±0.16	0.72b ±0.11	0.75ab ±0.11	S
Mn mg/100g	**Mean** **SD**	0.24 ±0.14	0.17 ±0.07	0.17 ±0.05	NS	0.20 ±0.11	0.17 ±0.11	0.18 ±0.05	0.18 ±0.06	NS

Each value in the table is represented as mean ± SD; NS: not significant according to LSD test (p<0.05)

4. DISCUSSION

The results of the foregoing analysis highlight the mineral contents variability of dates in relationship to their provenance and agronomic characteristics (maturity period and fruit consistency of the cultivar), which should orient their use as a good nutritive sources. In regards to their mineral composition, dates could represent a good source for some minerals such as potassium and iron. However, this interest is suspected to change within palm-trees geographical localization and agronomic characters such as maturity period and fruit consistency of cultivars.
Our results showed that water content in fruits was affected by the geographical provenance. Deglet nour dates from new oasis of Jerid and those of Alig from old Nefzaoua oases exhibited elevated moisture. This oases effect could be attributed for differences in irrigations techniques and / or soils humidity and structure variations (Al-Juburi et al., 1994, Al-Hooti et al., 1997). Also, it was admitted that water content is significantly influenced by fruit's maturity periods and consistencies. Early maturating dates such as those of Ammary, Hissa, Gosbi, Malti, Rtob Houdh and Rotbayet Jeddi cultivars contained an elevated percent of water. This fact will probably explain their soft consistency.

It was proved that the ripening process decreases the fruit moisture (Booij et al., 1992, Hulme, 1970). In this work, this effect is excluded because of all samples were obtained at the same ripening stage, the Tamer stage. Thus, the checked differences in the obtained results reflect the fruits qualities involvement. Hasnoui et al. (2011) showed that dates of early maturity cultivars had the highest water activity than dates of late maturing cultivars. This is in accordance with our results presenting that date's water content decreased when maturity is retarded. In addition, early maturity cultivars, in contrast to the later ones, had the highest moisture content and the lowest mineral content which would increase the water activity. The high water activity makes the fruit juicy (Ishida et al., 1997) which explain why dates of early maturing cultivars are soft. Munier (1973) concluded that the fruit consistency classification is based on water and sugar contents. The mineralogical traits have not distinguished the semi-soft and the semi-dry cultivars which was approved by morphologic (Hamza et al., 2009) and molecular (Hamza et al., 2011) characteristics. Further investigations, such as in sugar contents, should be completed to confirm the previous outcomes.
Ash content was significantly affected by the trees origin of Alig fruits. In fact, Alig dates from old Jerid manifest a deficit in ash in comparison to other studied oases, but their mean values were in accordance with previous study (Booij et al., 1992). For the fruit qualities, only the later maturing cultivars have showed the greater ash content. This high ash content may indicate a low synthetic activity of organic materials by the vegetative portions (Hass 1935, Booij et al., 1992). This argues the finding of Hamza et al. (2009, 2011) explaining the pinnae density and its impact on fruit maturity period.
The variation founded in mineral contents among the different cultivars is in agreement with those reported by Reynes et al. (1994). New Jerid oasis fruits of Deglet nour cultivar offered the highest mineral composition, in comparison to other oases. However, older Jerid oasis produced Alig fruits with important concentration in phosphorus (P), sodium (Na), iron (Fe) and magnesium (Mg), whereas in new oasis there is an important fruit content in manganese (Mn) and total ash. Since differences in these oases localizations, the minerals contents suggest possible differences in cultivar adaptation /resistance mechanism that could be involved in preferential accumulation of such elements. It is noteworthy, herein, to outline the lowest manganese content in fruits from old oases that could be indicator of the MFC disease affecting date-palm trees. The Manganese (Mn) was the only element for which significant deficiency were seen in adult leaflets from MFC-affected trees (Namsi et al., 2007).
In agreement with Booij & al. (1992) findings, our results showed important potassium contents in all the studied kinds of Dates. This mineral is strongly correlated with the accumulation of sucrose (Demolon

1968) which was proved to be concentrated in dry dates (Dowson and Aten, 1936). This brought back a reasonable explanation for the observed variations of potassium (K) content in this study.
Because of their affluence in potassium (K) and their fewer content sodium (Na), dates were proposed as dietetic for hypersensitive person (Sawaya et al., 1983). The challenge of this study was to delineate effects of geographical origin on mineralogical composition of dates, and therefore influence their nutritive values. So, it is suggested that fruits of Alig from both Nefzoua and Jerid new oases are better advised for hypertensive person's consumption, than those of old oasis, in view of their lowest one in sodium (Na). In addition, our results indicate that date pulp of early and soft cultivars contained higher concentration of Iron (Fe). Thus, a dietetic importance for early maturating and soft fruits is suggested to counteract anemia and to bring a nutritive supply for pregnant women. Also, dry dates are suggested to bring important potassium supplementation, especially for hypertensive patients.

5. CONCLUSION

Our results demonstrate that an association does exist between the mineral gradient concentration in date palm fruits, and their geographic origin, fruits consistency and maturity period. Taken together all of these agronomic patterns, consumers are better oriented to choose the adequately nutritive and healthy fruit. A much more redirected and applicable works could be envisaged to better define interrelationships between dates agronomic patterns, their biochemical composition, and their values as nutritive supply, as so as, in biomedicine and food industry.

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