Global Advanced Research Journal of Agricultural Science (ISSN: 2315-5094) Vol. 6(12) pp. 418-427, December, 2017 Special Anniversary Review Issue.
Available online http://garj.org/garjas/home

Full Length Research Paper

Chemical composition, antioxidant and antibacterial activity in Tunisian date palm seed

Mounira Metoui, Awatef Essid, Amira Bouzoumita and Ali Ferchichi

Laboratoire d'Aridoculture et Cultures Oasiennes Institut des Régions Arides de Médenine, Médenine 4119, Tunisie

Accepted 12 November, 2017

These edofel even common dates (*phoenixdactylifera L.)* cultivars from the coastal oasis of Gabes, and the noble variety Deglet Nour from the oasis of kebeli were analyzed for their main chemical composition, antioxidant and antibacterial activity. The sugar content was ranged between 1.20g/100g MS for Bouhattam and 3.80g/100g MS for Khadhouri cultivar. The phenolic content was ranged between 5.224g/100gMS for Baht and 9.532g/100g MS for Khadhouri cultivar. Khadhouri had also the highest total flavonoids content (3.82 g/100gMS). The higher antioxidant activity was found on the Khadhouri variety and was estimated about 55.47% of DPPH radical scavenging activity. It has been found that a linear relationship ($p<0.01$) exists between total phenolic content and inhibition percent. This by-product of date processing industries could be regarded as an excellent source of flooding redients with interesting technological functionality that could also be used in medicinal preparation as an important source of oil.

Keywords: anti bacterial; antioxidant*; date palm seed; polyphenol; flavonoid.*

INTRODUCTION

The date palm (*P*hoenix dactylifera L.) is an important crop in arid and semiarid regions. Date palm constitutes the principal source of remuneration and the basis of economy for the people living in Tunisian Sahara (Chaira et al.,,2007).P. dactylifera is a member of family Arecaceae, also known as Palmaceae (El Hadrami and El Hadrami ,2009). It is well known that the average weight of date seeds is about 10-15% of date weight(Besbes et al.,2005) .The fruit of the date palm is composed of a fleshy pericarp and seed. The edible part of date fruit is fleshy mesocarp which exist in between epicarp and hard endocarp (El Hadrami and El Hadrami ,2009;Hasnaoui et al.2011).Mesocarp of date fruit has more than 80% sugars and in remaining 20%has dietetic fibers, protein, lipids and ash (Hasnaoui et al.2011) .(Al Farsi et al 2007)reported that chemical composition of date has 3.1-7.1 % moisture, 2.3-6.4 % protein,5.0-13.2 % fat and 0.9-1.8 % ash. Seed also contain highest levels of phenolic (3102-4430 mg Gallic acid equivalent /100 g), antioxidant (580-929µm trolox equivalent/g) and dietary fiber (78-80g/100g) (Al Farsi et al.,2007). Phenolic compounds have been shown to possess such benefits as antioxidant, ant carcinogenic, antimicrobial, anti-inflammatory activities. (Martin. 2002).The antioxidant can prevent oxidative damages; increased intakes from the diet well also reduce the risk of chronic diseases (Bouskou Dimitries). As some synthetic

*Corresponding Author's Email: mounira.metoui@hotmail.com

antioxidant may exhibit toxicity, require high manufacturing costs and have lower efficiency than natural antioxidants (Madhavi, Despande, and Salunke, 1996). So there is a need to identify more sources of natural phenolic antioxidant and incorporated in food. Since a large quantity of date seed contain a significant amount of bioactive phenolic, the aim of this study was to evaluate chemical and mineral composition, phenolic, flavonoid and anthocyanin content as well as the antioxidant and antibacterial activities of date seed of some cultivars in maritime oasis of Gabes-Tunisia.

MATERIALS AND METHODS

Seed material

This study was conducted on common date of 11 varieties in coastal oasis of Gabes in Tunisia witch collected at "tamr stage" and Deglet Nour from the oasis of kebeli. The seeds were stoked in water. Nomenclature and characteristics of the studied 12 Tunisian date palm cultivars collection was shown in *table 1*.

Proximate analysis

Dry matter was determined according to the association official analytical chemists (AOAC,1990),fat content was determined by Soxhlet extraction with petroleum ether for 6 h at boiling point of the solvent (40-60°C). The extraction procedure was previously described by (Besbes *et al*., 2004).

Total nitrogen was determined by the Kjeldahl method. Protein was calculated using a factor of 6.25 (El-Shurafa et al.1982). Data were expressed as percent of dry weight.

Sugars were extracted with methanol (80%) by shaking 70°C for 30min, after centrifugation the supernatant was collected and the sugar content was analyzed with phenol/sulfuric acid reagent (Elleuch *et al*.,2007).

Determination of dietary fiber was carried out using the AOAC enzymatic gravimetric official method (AOAC 1995) .The sample was de-sugared by three extraction each with 85% ethanol (10ml\g) and then dried overnight at 40°C

Ash and mineral analysis

To remove carbon, about 1g (powdered) of each cultivar, in a porcelain container, was ignited and incinerated in the muffle furnace at about 550°C for 8h.The total ash was expressed as percent of dry weight. The mineral constituents (Na,K) present in the date seeds of each cultivar were analyzed separately, using a flame photometer.

The samples were prepared for analyses as described by (Al-Showiman 1990).

Phosphorus content (P) was determined by the phosphomolybdovanate method (AOAC,1990).

Total phenolic

The total phenolic content of seed extracts was determined according to the folin-ciocalteu's method (Yoo, lee 2004). One milliliter of seed extracts was mixed with 1ml of folinciocalteu's phenol, after 5min, 10 ml of 7%sodium carbonate solution (w/v) were added, and the final volume was made up to 25ml with dionised water. After 1 H of reaction at room temperature, the absorbance at 750nm was read using a thermo spectrophotometer. Measurements were calibrated to a standard curve of prepared Gallic acid solution. The total phenolic concentration was expressed as grams of Gallic acid equivalent per 100 g of the sample on a weight basis.

Total flavonoid

The total flavonoid of extract seed was determined according to (Al Farsi et al.,2008).One milliliter of extract seed was mixed with 5ml of deionized water then 0.3ml of 5% sodium nitrite was added, after 5min of 1M aluminum chloride was added and diluted with deionized water to final volume was up to 10 ml. after mixing, the absorbance at 510nm was immediately read using a thermo spectrophotometer. Measurements were calibrated to a standard curve of prepared catching solution. The total flavonoid content was expressed as grams of catechin equivalent per 100 g of sample on a wet weight basis.

Determination of Total Anthocyanin Content

Total anthocyanin content was determined by pH differential method using two buffer systems: potassiumchloride buffer (pH 1.0, 0.025 M) and sodium acetate buffer (pH 4.5, 0.4 M). Methanolic extract were mixed with3.6 ml of corresponding buffers and read against water as a blank at 510 and 700 nm (Elfalleh et al .,2011) . Absorbance (A) was calculated using this formula A =[(A510 –A700) pH1.0 - (A510 –A700) pH4.5]
With a molar extinction coefficient of 2960. Results were expressed as mg of cyanidin-3-glucoside equivalents (CGE) per g dry weight.

Radical scavenging activity on DPPH

The free radical scavenging capacity of the compound test was determined wit 1.1-diphenylhy-drazyl (DPPH) (Chaira et al., 2007). An aliquot of each tested extracts was mixed with 23.6µg ml^{-1} of DPPH solution (in ethanol) ($v.v^{-1}$). After incubation of the mixture for 30min, the absorbance of the

Table1. Nomenclature and characteristics of the studied 12 Tunisian date palm cultivars collection.

Accession	Maturity period	Consistency of the fruit
Lemsi	Early September	Semi soft
Amari	October	Soft
Hammouri	October	Semi soft
Korkobi	October	Soft
Matata	September	Soft
Halwaya	September	Soft
Rochdi	Early October	Semi soft
Deglet Nour	October	Semi soft
Baht	September	Soft
Bouhattam	Early October	Semi dry
Eguiwa	October	Semi soft
Khadhouri	September October	Semi dry

remaining calorimetrically at517nm and acid ascorbic was used as a control.
Antioxidant activity was calculated using the equation:
% Antioxidant activity =100× (1-A_{ech} /A_c)
With - A_{ech} is the absorbance of sample
- A_c is the absorbance of sample studied cultivars

Anti bacterial activity

Date seed were tested against (*E .coli* ATCC 35218, *Salmonella Typhinurium* ATCC 1408, *Enterococcus feacalis* ATCC 29212, *Staphylococcus aureus* ATCC 25923, *Staphylococcus epidermis* CIP 106510).
Date seed extracts were dissolved in three different solvent (water, methanol and acetone) and were sterilized by filtration on 0.45 mm Millipore filters. Disc diffusion method was employed for the determination of antibacterial activity of the extracts. A total of 100 mL of suspensions containing 10^6 CFU/mL of bacteria, in exponential growth phase, on Mueller-Hinton agar medium Filter paper disks (9 mm of diameter) were impregnated with 50 mL of each extract (7.5 mg/disc) and placed on the in oculated Petridishes. Negative control was performed using
Different solvent (water, methanol and acetone) employed to dissolve the different extracts. Ciprofloxacin (100 mg/disc), oxacillin (500 mg/disc) and lamidaz (100 mg/disc) were individually used as positive controls for bacteria. Petridishes were then incubated during 24 h at 37 °C for bacterialstrains. Antibacterial activity was evaluated by measuring the inhibition zone (mm) against the studied microorganisms, including disc diameter (Mahmoudi et al .,2015)

Statistical method

All analytical determinations were performed in triplicate. Statistical analysis was performed using SPSS for windows. Data obtained was analyzed using analysis of variances to determine the significance ($p<0.05$) of the main effects flowed by Turkey's multiple comparison test for significance of difference. Values of different parameters were expressed as the mean ± standard deviation. In addition, to evaluate the information contained in experimental data, principal component analysis (PCA) was applied relationship is analyzed by XLSTAT_ pro 7.5 and to construct a dendrogram between 12 Tunisian populations using the arithmetic averaging (UPGMA) algorithm.

RESULTS

Proximate analyses

The moisture content shown in *Table 2* ranged between 17.18%for Rochdi variety and 29.47 % for Lemsi variety, however this content of water could reach highest value in other varieties, like moisture concentrations of Deglet Noor was 13.06, protein ranged from 5.23% to 7.02%.
The date seed containing a significant amount of fat ranged between 4.88 for Matata variety and 7.81 for Halwaya variety. A significant differences ($p<0.05$) in fat content were observed between the different studied cultivars.

Table 2: Chemical composition (dry basis) of date seeds from the twelve studied cultivars. All values given are means of three determinations

Cultivars	protein	fat	moisture	Dietary fiber	Sugar
Lemsi	5.44±0.12ef	4.97±0.04g	25.23±0.05d	75.48±0.32efg	1.86±0.02g
Amari	6.48±0.22bc	5.95±0.07e	19.39±0.04g	73.83±0.33h	2.56±0.02e
Hammouri	6.82±0.03ab	6.81±0.04c	18.46±0.15h	75.78±0.04de	1.88±0.03g
Korkobi	6.96±0.01a	5.23±0.06f	19.63±0.09g	76.56±0.21d	3.17±0.03c
Matata	5.76±0.01de	4.88±0.08g	29.47±0.04b	79.54±0.01b	3.44±0.01b
Halwaya	7.02±0.01a	7.81±0.04a	17.8±0.07i	75.6±0.16de	2.82±0.01d
Rochdi	6.13±0.05cd	6.7±0.12c	22.16±0.04f	74.71±0.36fgh	3.41±0.07b
Deglet Nour	5.51±0.01ef	7.4±0.05b	23.55±0.22e	78.4±0.27c	2.68±0.02e
Baht	5.23±0.02f	4.93±0.01fg	27.72±0.04c	75.83±0.01de	2.12±0.01f
Bouhattam	5.65±0.01e	5.06±0.01fg	33.61±0.06a	78.77±0.01bc	1.21±0.01h
Eguiwa	6.96±0.01a	5.9±0.06e	16.06±0.03k	74.46±0.01gh	1.74±0.02g
Khadhouri	6.72±0.01ab	6.4±0.03d	17.18±0.01j	82.37±0.01a	3.81±0.01a

Table 3: Mineral composition of date seeds from the four studied cultivars.

Cultivars	Ash*	Sodium**	Phosphorus**	Potassium**
Lemsi	0.92±0.01e	10.61±0.01 i	68.33±0.33f	204.33±2.6g
Amari	1.04±0.01d	16.13±0.01c	112±0.58b	262.67±1.33d
Hammouri	1.27±0.01b	16.18±0.01c	120±0.58a	280.67±0.67c
Korkobi	1.19±0.01c	12.18±0.02f	78.67±0.88de	223±1^{e}
Matata	0.97±0.01e	11.53±0.01g	73.67±0.88ef	214.33±0.33f
Halwaya	1.15±0.02c	13.52±0.02d	78.33±0.33de	218.67±0.88ef
Rochdi	1.35±0.03a	17.83±0.01a	124±0.58a	300±1.15 a
Deglet Nour	1.26±0.01b	16.07±0.03c	118±0.58ab	289.33±0.33b
Baht	0.94±0.01e	11.22±0.01h	68.33±0.33f	220.1±0.12^{e}
Bouhattam	0.96±0.01e	12.3±0.12f	84±0.58d	219±0.58ef
Eguiwa	1.14±0.01c	13.3±0.06^{e}	120±3.46a	290±0.58b
Khadhouri	1.26±0.01b	16.7±0.06b	99±1.15c	287.47±0.26b

All values given are means of three determinations
*: in % of dry weight basis
**: in mg/100g of dry weight

A significant difference ($p<0.05$) in sugar contents were observed between the different varieties. Khadhouri presented the highest quantities of sugar (3.8%).

In our study, the highest amount of dietary fiber was noted in Deglet Nour varieties with (82.37%).

Minerals determination

In our study date seeds also contained significant amount of important minerals (Table3). The potassium concentration was the highest followed in descending order by phosphorus and sodium.

Table 4: Mean values of total polyphenols, flavonoids, carotenoides, anthocyanes and DPPH of palm date seeds

Cultivars	polyphenol	Flavonoid	Antocyanes	DPPH
Lemsi	5.13±0.01 j	1.43±0.02 k	0.25±0.02gh	33.12±0.01 k
Amari	8.14±0.01 d	3.22±0.01 d	0.32±0.01f	50.45±0.02 d
Hammouri	6.5±0.01 g	1.98±0.01 h	0.46±0.01cd	40.56±0.01 i
Korkobi	9.41±0.01 b	3.83±0.01 a	0.48±0.01c	55.47±0.01 a
Matata	7.13±0.01 f	2.39±0.03 f	0.53±0.02b	42.13±0.01 g
Halwaya	7.85±0.01 e	2.52±0.01 e	0.38±0.01^{e}	44.3±0.01 f
Rochdi	8.72±0.02 c	3.23±0.02 d	0.46±0.01cd	49.72±0.01 e
Deglet Nour	7.14±0.01 f	2.31±0.01 g	0.61±0.01a	41.32±0.01 h
Baht	5.22±0.01 i	1.54±0.01 j	0.2±0.01h	34.88 j
Bouhattam	5.82±0.02 h	1.63±0.01 i	0.26±0.01g	42.16±0.01 g
Eguiwa	9.48±0.02 a	3.61±0.01 c	0.41±0.01de	51.52±0.01 c
Khadhouri	9.53±0.01 a	3.68 b	0.46±0.01cd	54.58±0.01 b

Table 5: correlation between DPPH, flavonoid, polyphenol and anthocyanin

	DPPH	Flavonoid	polyphenol	anthocyanin
DPPH	1			
flavonoid	0,96	1		
polyphenol	0,96	0,99	1	
anthocyanin	0,42	0,47	0,54	1

** Correlation is significant at the 0.05 level

Potassium was the highest mineral content in all samples ranged between 300 mg/100g

DW determined in Rochdi seeds and 204.33 mg/100g DW in Lemsi seeds, followed by phosphorus ranged between 124mg/100g DW determined in Rochdi seeds and 68.33mg/100g DW observed in Lemsi and Baht seed. The sodium was the lowest; it varied between 17.8mg/100g DW in Rochdi variety and 11.22 mg/100g DW in Bahtseeds. XLSTAT-Pro7.5 showed The correlation between the different compounds of important minerals which evaluate that the highest significant correlations was between the phosphorus contents and the potassium contents 0.94 in decreasing order by potassium-sodium 0.87 and phosphorus-sodium 0.85.

Total polyphenols, flavonoids and anthocyanin* content*:

Polyphenols contents of twelve varieties are presented in Table 4. The total phenols expressed as mg Gallic acid equivalents per g dry weight (mg GAE/g DW).

A significant differences ($p<0.05$) in total phenolic contents were observed between the different studied cultivars. Khadhouri contained the highest total phenolic content of (9,532g of GAE/100g) whereas Lemsi had the lowest total phenolic (5.13g of GAE/100g)

In our study, the Total flavonoid ranged from 1.43 gCAE/100gMS in Lemsi variety to 3.83gCAE/100gMSin Korkobi variety. A significant difference ($p<0.05$) in total flavonoid contents were also observed between the different varieties

Date seed content for Total anthocyan in was different among different varieties with Baht 0.2 mg of cyanidin-3-glucoside equivalents per g dry weight (mg CGE/ g DW) being the lowest, while Deglet Nour 0.61(mg CGE/ g DW) being the highest

Free radical scavenging: Test DPPH

The results of antioxidant capacity were shown in Table 4. In our study There are a significant difference ($p<0.05$) relative to the percent of inhibition between the studied varieties. Khadhouri present the highest antioxidant activity (55.470 %).The lowest activity was observed in Baht variety (33.120 %).

Table 6: Antibacterial activity of different extract of date palm seed against gram negative organisms

Inhibition diameter (mm)									
	Staphylococcus aureus			*Staphylococcus epidermis*			Enterococcus *feacalis*		
	M	A	W	M	A	W	M	A	W
Lemsi	22.23^{A}	19.43^{B}	5.73^{E}	21.20^{BC}	18.57^{BC}	5.63^{D}	----	----	----
Amari	21.60^{B}	19.33^{BC}	5.30^{F}	20.57^{D}	19.20^{A}	6.63^{A}	----	----	----
Hammouri	19.93^{D}	18.43^{DE}	5.83^{DE}	21.03^{C}	18.60^{BC}	5.97^{CD}	----	----	----
Korkobi	22.30^{A}	18.43^{DE}	6.63^{AB}	19.77^{E}	17.73^{E}	6.40^{AB}	----	----	----
Matata	18.67^{E}	17.50^{G}	6.50^{B}	21.70^{A}	18.30^{D}	6.10^{BC}	----	----	----
Halwaya	19.60^{D}	17.77^{G}	6.63^{AB}	21.40^{B}	19.20^{A}	6.03^{BC}	----	----	----
Rochdi	20.73^{C}	18.07^{F}	6.13^{C}	20.60^{D}	18.30^{D}	6.60^{A}	----	----	----
Deglet Nour	21.40^{B}	18.27^{EF}	6.07^{CD}	19.50^{E}	18.40^{CD}	5.93^{CD}	----	----	----
Baht	21.37^{B}	18.60^{D}	6.20^{C}	20.50^{D}	19.17^{A}	6.13^{BC}	----	----	----
Bouhattam	22.43^{A}	19.07^{C}	6.67^{AB}	21.33^{B}	18.70^{B}	6.30^{ABC}	----	----	----
Eguiwa	21.27^{BC}	19.37^{B}	6.50^{B}	20.60^{D}	18.50^{BCD}	6.40^{AB}	----	----	----
Khadhouri	17.67^{F}	21.50^{A}	6.80^{A}	18.33^{F}	19.30^{A}	5.93^{CD}	----	----	----

Table 7: Antibacterial activity of different extract of date palm seed against gram negative organisms

Inhibition diameter (mm)						
	Salmonella thphimirum			*Escherichia coli*		
	M	A	W	M	A	W
Lemsi	19.23^{A}	16.87^{C}	6.67^{A}	21.27^{FG}	18.50^{DE}	6.13^{BC}
Amari	18.37^{B}	16.33^{DE}	5.23^{D}	21.93^{E}	17.87^{F}	5.17^{FG}
Hammouri	19.47^{A}	17.23^{B}	5.83^{C}	22.20^{DE}	18.53^{DE}	5.80^{CD}
Korkobi	19.30^{A}	17.13^{B}	6.67^{A}	27.87^{A}	22.80^{B}	6.40^{AB}
Matata	18.47^{B}	16.40^{DE}	6.23^{B}	24.27^{C}	17.10^{G}	5.37^{EFG}
Halwaya	18.50^{B}	16.70^{C}	6.20^{B}	23.93^{C}	18.30^{E}	5.13^{G}
Rochdi	16.67^{E}	15.13^{G}	5.30^{D}	22.17^{DE}	17.90^{F}	5.50^{DEF}
Deglet Nour	17.47^{D}	15.30^{FG}	5.47^{D}	21.57^{F}	16^{H}	5.10^{G}
Baht	17.90^{C}	16.23^{E}	5.33^{D}	21.10^{G}	18.60^{D}	5.53^{DE}
Bouhattam	19.43^{A}	18.50^{A}	5.23^{D}	22.50^{D}	19.50^{C}	5.80^{CD}
Eguiwa	19.37^{A}	16.47^{D}	5.27^{D}	21.30^{FG}	17.83^{F}	5.57^{DE}
Khadhouri	15.50^{F}	15.33^{F}	5.87^{C}	24.73^{B}	23.30^{A}	6.70^{A}

Antioxidant capacity of date seed was significantly correlated with phenolic contents (r = 0.96) and with flavonoid values (r = 0.96) but not with anthocyanins values (r= 0.42) (p<0. 05) so This difference in the antioxidant capacity was explained by the khadhouri seed's which has the higher level of polyphenol and flavonoid than the other cultivars.

antibacterial activities

In the present investigation the antibacterial activity are given in the tables 6 and 7 .Antimicrobial activity was recorded against five pathogen bacteria (*Escherichia coli, staphylococcus aureus, staphylococcus epidermis, Salmonella Typhinurium*, Enterococcus *feacalis*) which

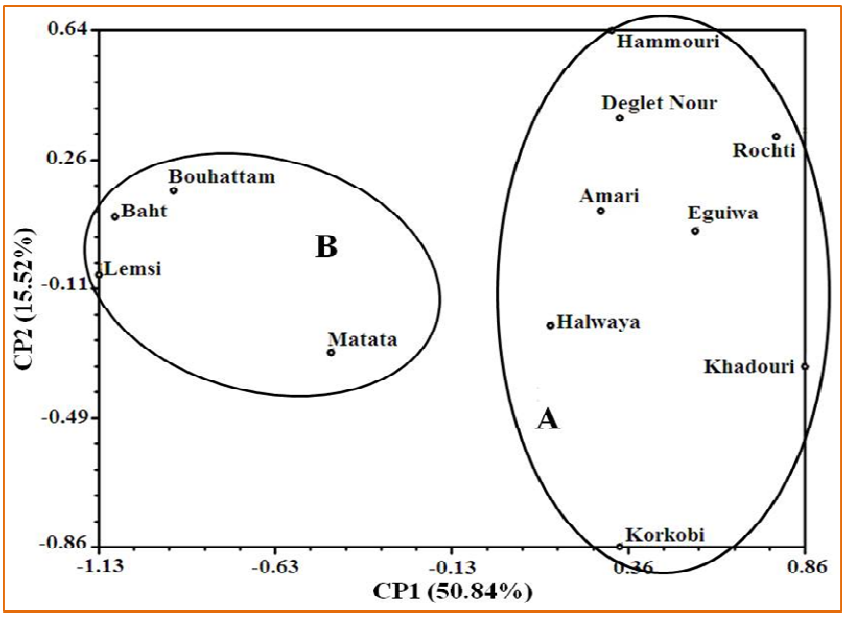

Figure1: Principal component analysis, dispersion of Tunisian date palm variety in planes formed by axes F1 and F2 of the PCA.

clearly show that all the extract have shown antibacterial activity except Enterococcus *feacalis.*

The acetone and methanol extracts had shown good antibacterial activity against Escherichia coli, staphylococcus aureus, staphylococcus epidermis, Salmonella Typhinurium whereas water extract had very little effect on all test bacterial species.

Methanol extracts of date seed was most effective against all tested bacterial followed by acetone and aqueous extract.

The data on zone of inhibition demonstrate that Deglet Nour has not the most antibacterial activity against gram negative and gram postive organisms whereas common date like Bouhattam has inhibition diameter (22.43 mm) against staphylococcus aureus and 19.43 mm against salmonella Typhinurium, matata 21.70 mm against staphylococcus epidermis and korkobi 27.87 mm against Escherichia coli.

Methanol extracts howed maximum zone of inhibition against Escherichia coli (27.87) followed by staphylococcus aureus, staphylococcus epidermis and Salmonella Typhinurium (22.33,21.70,19.43)

Cluster and principal component analyses

To elucidate the chemical relationships between the studied Tunisian common date palm accessions, a dendrogram was built using UPGMA The dendrogram assorted the studied 12 accessions into two groups (Figure. 1). The group (B) contains four accessions ('Matata ', 'Baht', 'Lemsi' and 'Bouhattam') and the other one (A) includes the remaining of accessions. 'Deglet Nour' obtained from Kébéli oasis clustered among the other accessions from Gabés oasis indicating probably a common genetic basis among Tunisian date palms.

Figure 2 presents the cultivars distribution according to the first two components (PCA1 and PCA 2) in which two groups corresponding to those detected in the UPGMA analysis may be observed.

DISCUSSION

The above differences in moisture content may be attributed to the variability of varieties and especially to the origin of cultivars. Differences observed for the same cultivar are due mainly to the climate conditions, harvesting period and drying conditions and storage. The rate of moisture reduces from 85% at first stage to 24% full ripeness during the development of dates. Sometime it is equal and / or closely related to relative humidity of the atmosphere (Hasnaoui 2011). In another study, (Ismail et al. 2008) found that moisture level in two date varieties ranged from 20.7% to 26.7%.

Amari contained the highest fat content 7.81% and Lemsi contained the less content 4.88 %.These results were less than those reported by (Besbes et al., 2004) who found1 0.19% in Deglet Nourvariety grown in Tunisia. (Nadeem et al.2011) reported that fat in different date varieties ranged from 0.1% to 0.5%. This percent

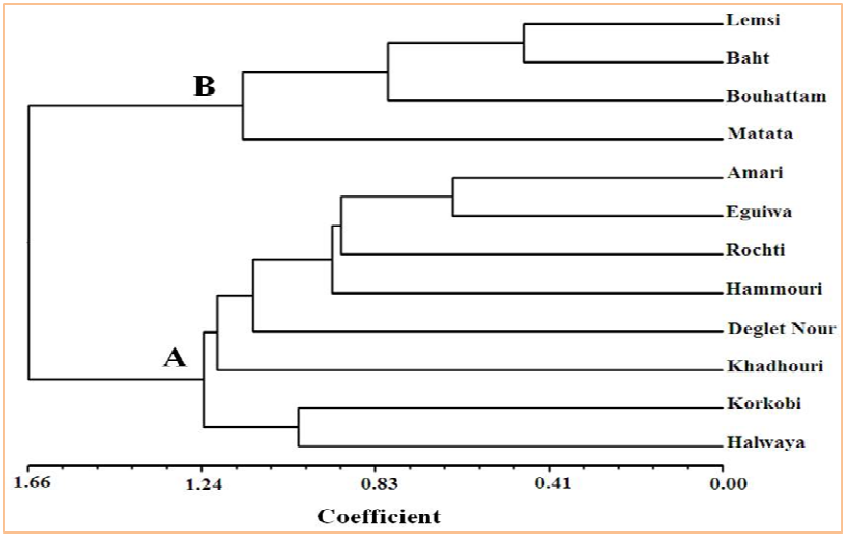

Figure 2: Dendrogram ofthe12 Tunisian date palm by UPGMA methods using the similarity matrix based on chemical analysis.

favorite the extraction of seed oil which have many benefits effect. The study of two Tunisian cultivars by Besbes and her collaborate showed that date seed oils contain high relative percentages of oleicacid. They are also more yellow-colored than other vegetable oils and they can protect against UV light responsible form uchcellulard amage. Date seed oils could easily be conserved due to their high oxidative ability. Regarding these specificities, the value of this by- product in cosmetic and food industries may be justified. However, the antioxidant composition of date seed oil must be tested to more valorize this by-product.

Date pits from four different varieties contained 5.23 –6. 96%protein .These results were in general agreement with those reported by Besbes et al. (2004) oxidative stability ,(Hamada et al., 2002), (Rahman et al., 2007). However (Ismail et al 2006) studied five date varieties of UAE and reported that protein level ranged between 2.3-2.7%. Since the rote in content in date pits is small and the proteins may not be very digestible, date pit proteins need to be investigated further to explain their poor solubility and to recover them for potential food use.

Total sugars are in broad agreement with data of El-Shurafa et al. (1982) and (Rahman et al. 2007) but less than those reported by (Chaira et al.,2007) and (Al-Showiman et al., 1990). Those differences may be attributed to the variability of the studied cultivars The difference among the twelve date seed varieties can be attributed to differences between cultivars, degree of ripeness, latitude, environmental conditions, processing techniques and storage conditions.

The results of phenolic contents were less than those reported by (Al Farsi et al., 2007) Who found 10.3 g/100g in varieties grown in Oman.

The difference could be explained by various factors such as variety, growing condition, maturity, season, geographic origin, fertilizer, soil type, storage condition, amount of sunlight received, culture methods, process and stabilization conditions, use of different analytical methods and use of different phenolic standard. (Al Farsi et al. 2007; Besbes et al., 2004; Besbes et al., 2008).

In comparison with date pulpe which ranged between 2.49 and 8.36mg/100g reported by Abdelhak Mansouri et al., 2004). Seed may be considered as a rich source of phenolic compounds. Because of the highest phenolic content, seed could be used in functional foods, food additives, pharmaceuticals and cosmetic industries (Shahidi and Naczk, 2004).

Flavonoids present in plants possess diverse health benefits, which includes antioxidant and radical scavenging activities, reduction of certain chronic diseases, prevention of some cardiovascular disorders and certain kinds of cancerous processes. Baliga et al (2011)

The results of flavonoids contents were less than those reported by (Al Farsi et al., 2007). who found 5.4g/100g in varieties grown in Oman. Flavonoids present in plants possess diverse health benefits, which includes antioxidant and radical scavenging activities, reduction of certain chronic diseases, prevention of some cardiovascular disorders and certain kinds of cancerous processes

This difference could be explained by the variability of the studied cultivars.

Generally, flavonoid content is known to be highly dependent either on the cultivar or on the

growing/processing condition (Harnly et al., 2006; Chaira et al., 2009).

Date seed presented an interesting antioxidant capacity to scavenging DPPH free radicals and it seems to be used in food as an important source of antioxidant.

Results are in agreement with the literature. Qualitatively, the antibacterial activity is similar to previous findings Saleh FA, Otaibi MM (2013)

Parshanth et al., (2001) and Al-Zoreky NS (2009) proved that methanolic extract of pomegranate peels were more active than water extracts against some pathogenic bacteria. Shen et al. (2014) found antimicrobial effect of blueberry (are rich in phenolics) extracts against Listeriamonocytogenes and Salmonella Enteritidis. The antibacterial activity of date extracts may be due to the phenolic compound which more extracted with ethanol and methanol than water

Polyphenolsplay an important role as antibacterial activity through the precipitation of proteins and inhibition of enzymes of microorganisms. The antibacterial activity of date extracts may be due to the phenolic compound (Rauha et al 2000), (Pereira et al 2007 b)

CONCLUSION

The present study was carried out for the first time on Tunisian date seed varieties of Gabes oasis to access their therapeutic and technological values. Considering the polyphenol, flavonoid contents and the inhibitory capacity of date seed extracts, we can conclude that this by – product of date could be used an excellent source of antioxidant in food and medicine preparation.

REFERENCES

Al-Farsi M, Alasalvar C, AL-Abid M, AL-Shoialy K, AL-Amri M, Al-Rawahy F (2007). Compositional and functional characteristics of dates, syrups, and their by-products, Food Chemistry 104, 943–947

Al-Farsi M, Alasalvar C, Morris A, Barron M, Shahidi F (2005). Comparison of anti-oxidant activity, anthocyanins, carotenoïds, and phenolic of three native fresh and sun-dried dates (Phoenix dactyliferayi t L.). Journal of Agricultural and Food Chemistry, 53, 7592–7599.

Al-Farsi M, Yong Lee C (2008). Optimization of phenolic and dietary fiber extraction from date seeds, Food Chemistry 108 , 977–985

Al-Zoreky NS (2009). Antibacterial activity of pomegranate (Punicagranatum L.)fruit peels. International Journal of Microbilology 134: 244-248.

Baliga SM, Baliga BRR, Kandathil SM, Harshith PB, Kumar V (2011). A review of the chemistry and pharmacology of the date fruits (Phoenix dactylifera L.) Food Research International 44 (2011) 1812–1822

Besbes S, Blecker C, Deroanne C, Drira NE, Attia H (2004). Date seeds: Chemical composition and characteristic profiles of the lipid fraction. Food Chemistry, 84, 577–584.

Besbes S, Blecker C, Deroanne C, Lognay G, Drira NE, Attia H (2004a). Date seed oil: physico-chemical characteristics and oxidative stability during storage. Food Science and Technology International, 10, 333–338

Besbes S, Blecker C, Deroanne C, Lognay G, Drira NE, Attia H (2005). Heating effect on some quality characteristics of date seed oil .Food chemistry, 91,469-476.

Besbes S, Drira L, Blecker C, Deroanne C, Attia H (2008). Adding value to hard date (Phoenix dactylifera L.): Compositional, functional and sensory characteristics of date jam .Food chemistry, 112, 406–411.

Chaira N, Issam SM, Martinez-Tome M, Mrabet M, Murcia M, Ferchichi A (2009a). Simple phenolic composition, flavonoid contents and antioxidant capacities in water-methanol extracts of Tunisian common date cultivars (Phoenix dactylifera L.)International Journal of Food Sciences and Nutrition, 60, 316-329

Chaira N, Mrabet M, Ferchichi A (2009). Evaluation of antioxidant activity, phenolic, sugar and mineral contents in date palm fruits. Journal of Food Biochemistry, 33**,** 390–403.

El Hadrami I, El Hadrami A (2009). Breeding Date Palm. In S.M. Jain, P.M. Priyadarshan (eds.), Breeding Plantation Tree Crops: Tropical Species, C Springer Science+Business Media, LLC 200

Elfalleh W, Tlili N, Yahia Y, Hannachi H, Nasri N, Ferchichi A (2011). Total Phenolic Contents and Antioxidant Activities of Pomegranate Peel, Seed, Leaf and Flower .journal of Natural Product Communications . vol 6

Harnly JM, Doherty RF, Beecher GR, Holden JM, Haytowitz DB, Bhagwat SA, Gebhardt SE (2006). Flavonoid content of U.S. fruits, vegetables and nuts. J Agric Food Chemistry 5,966,977

Hasnaoui A, Elhoumaizi MA, Hakkou A, Wathelet B, Sindic M (2011). Physico-chemical characterization, classification and quality evaluation of date palm fruits of some Moroccan Cultivars. J. Sci. Res. 3 (1), 139-149.

Ismail B, Haffar I, Baalbaki R, Mechref Y, Henry J (2006). Physico-chemical characteristics and total quality of five date varieties grown in the United Arab Emirates. Intr. J. Food Sci. Tech. 41:919-926.

Madhavi DL, Despande SS, Salunke DK (1996). Food antioxidants. New York: Marcel Decker.

Mansouri A, Embarek G, Kokkalou E, Kefalas P (2005). Phenolic profile and antioxidant activity of the Algerian ripe date palm fruit (Phoenix dactylifera). Food Chemistry, 89, 411–420.

Martin S, Andriantsitohaina R (2002). Cellular mechanism of vasculo-protection induced by polyphenols on the endothelium, Annales de cardiologieetd'angéiologie, 51, 304–315

Muhammad Nadeem Salim-ur-Rehman, Faqir Muhammad Anjum, Ijaz Ahmad Bhatti (2011). Quality evaluation of some pakistani date varieties. Pak. J. Agri. Sci., Vol. 48(4), 305-313; 2011

Parshanth D, Asha M, Amit A (2001). Antibacterial activity of Punicagranatum. Fitoterapia 72: 171-173.

Pearson D (1976). The chemical analysis of foods. London, New York: Churchill-Livingstone. pp. 142–151.

Pereira JA, Oliveira I, Sousa A, Valentao P, Andrade PB (2007b). Walnut(Juglansregia L.) leaves: phenolic compounds, antimicrobial activity andantioxidant potential of different cultivars. Food Chemistry Toxicology 45: 2287-2295.

Rauha JP, Remes S, Heinonen M, Hopia A, Kahkonen M (2000). Antimicrobial effects of Finnish plant extracts containing flavonoids and other phenolic compounds. Int J Food Microbiol 56: 3-12.

Saleh FA, Otaibi MM (2013) Antibacterial Activity of Date Palm (Phoenix Dectylifera L.)Fruit at Different Ripening Stages. J Food Process Technol 4: 285. doi:10.4172/21577110.1000285

Shahidi K, Naczk (2004). Extraction and analysis of phenolics in food. Journal of chromatography

Shen X, Sun X, Xie Q, Liu H, Zhao Y (2014). Antimicrobial effectof blueberry (Vacciniumcorymbosum L.) extracts against the growth of Listeriamonocytogenes and Salmonella Enteritidis. Food Control 35: 159-165.

Yoo KM, Lee KW, Park JB, Lee HJ, Hwang IK (2004).Variation in major antioxidants and total antioxidant activity of Yuzu (Citrus junos Sieb ex Tanaka) during maturation and between cultivars. Journal of Agricultural and Food Chemistry, 52, 5907–5913.