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***Short Communication***

# Chemical Composition and Microbial Quality of Dates Grown in Figuig Oasis of Morocco

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## ABSTRACT

In Figuig oasis of Morocco, dates played an important role in the economic and social lives of the people. Common dates varieties were investigated for biochemical and microbiological composition. Date flesh of all varieties showed high level of total sugars (62.60-83.32%) and a small amounts of protein (2.3-3.85%), ash (2.15-3.46%) and fat (0.1-0.46%) on dry matter basis. Although the mineral contents varied widely, all varieties could be an important source of potassium. Potentially pathogenic bacteria like *Escherichia coli*, *Bacillus cereus* and coliforms were not identified in any of the samples. The most abundant genus found was *Aspergillus niger*. 

**Key Words:** Dates; Morocco; Sugars; Water activity; Ash; Fungi; Pathogens

## INTRODUCTION

Dates, fruits of the date palm (*Phoenix dactylifera* L.) are a main source of staple food in arid and semi arid regions of North Africa, middle east and South-Asian countries. Dates have always played an important role in the economic and social lives of people of this area.

Botanically date fruit is one-seeded berry consisting of fleshy mesocarp covered by a thin epicarp, a hard endocarp surrounding the seed (Munier, 1973). Date fruit is highly nutrious food product, rich in calories and many vitamins and mineral. Some dates varieties ripen early in the season, whistle others are not mature until the end of the season (Dowson, 1982). Because of variable growth conditions and genetic differences, dates vary widely in their final appearance, organoleptic, physical and chemical characteristics. These parameters could be successfully be utilised for product development, quality control, process equipment design, shelf life prediction, packaging and storage.

Chemical composition of date palm fruit has been reported by various researchers (Sawaya *et al*., 1982; Booij *et al*., 1992; Reynes *et al*., 1994; Al Hooti *et al.*, 1995; Al Shahib and Marchal, 2003; Ismail *et al*., 2008; Elleuch *et al*., 2008; Biglari *et al*., 2009); but only a few reports are available on the dates varieties growing in Morocco, especially from Figuig oasis (South -East of Morocco). The estimated number of palm trees in this region is between 190 000, which presents 2.8% of total Moroccan date palm (Haddouch, 1996). There are over 30 different varieties of dates in Figuig oasis, little information concerning composition and microbial quality is available. For this reason, aim of this study was to determine variability in the composition and microbiological quality of the important varieties growing in Figuig oasis of Morocco.

## MATERIALS AND METHODS

**Samples:** Ten important varieties of date palm fruits grown in Figuig oasis of Morocco were harvested at edible maturation stage in August and September 2008 for Aziza manzou, Tadmamt, Tardbayt, Taâbdount date palm cultivars and in October and November 2008 for Assiane, Boufeggous, Boufeggous gharas, Aziza bouzid, Afroukh ntijent and Admam date palm cultivars. The harvesting was carried out in traditional way with only the appreciation and experience of the farmer. Tow kilogram of date fruits from each cultivar were collected and stored at 3°C±1 prior to chemical analysis. Microbial analyses are conducted immediately after harvesting.

**Chemical analyses:** The moisture content was determined using vacuum oven at 70°C for 48 h (AOAC, 1990; Reynes *et al*., 1994). Water activity of the samples was measured by a water activity meter (Rotronic). Total Nitrogen was determined by the Kjeldahl technique (AOAC, 1990), protein was expressed using the general factor 6.25 (Paul &

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Southgate, 1998). Lipid was determined from dried date macerated by Soxtherm Gerhard extractor (AFNOR, 2002). Ash content was determined by difference after heating macerated samples of date in a muffle oven (Nintherband) for 8 h at 600°C. Sugars were extracted from macerated dates by water at 85°C. They were quantified using the 3-5, dinitrosallicylic acid method (Barbin, 2006). Analysis of potassium (K), iron (Fe) and magnesium (Mg) was carried out with atomic absorption spectrophotometer (ICP AES Ultima 2JY model).

**Microbiological analysis:** Samples (10 g) of dates were aseptically weighed into sterile stomacher bags and 90 mL sterile Ringer solution was added. Samples were then homogenized for 10 min and aliquots (0.1 mL) were plated out directly or as 10-fold dilutions in Ringer's solution. Bacterial and fungal colonies were counted and expressed as colony forming units (cfu. $g^{-1}$). Total viable counts were determined using Plate Count Agar at 37°C for 48 h. Shapman medium was used to enumerate staphylococcus at 30°C for 48 h. Bacillus cereus was enumerated using Plate Count Agar after heating samples at 70-80°C for 10 min. The Man Rogosa Sharpe medium was used to enumerate lactic acid bacteria. The plates were incubated at 30°C for 48 h. Potato Dextrose Agar medium was used for selective enumeration of yeast and Malt Agar medium for selective enumeration of moulds; the plates were incubated at 30°C for 7 days. Desoxycholate Lactose Agar medium was used to enumerate coliform microorganisms.

**Statistical analysis:** Chemical analyses are reported on percentage in dry matter. The mean values of three determination and standard deviation are reported.

## RESULTS AND DISCUSSION

**Chemical composition of date flesh:** The date flesh for all varieties was characterized by the predominance of sugar, low percentage of ash, fat and protein (Table I). This result is similar to that reported by other authors for other varieties (Booij *et al.*, 1992; Youssef *et al*., 1992; Sawaya *et al*., 1983; Ahmed *et al*., 1995; Elleuch *et al.*, 2008). The crude protein content ranged from 2.32 to 3.87%. The crude fat content ranged from 0.1 to 0.46%, which are similar to those reported by Sawaya *et al.* (1983) for dates grown in Saudi Arabia, Ahmed *et al.* (1995) for dates grown in the United Arabe Emirate; but are low compare to those of some Iranian varieties (0.4 to 0.9% of fat) Ejlali *et al*. (1975). Fat is mainly concentrated in the skin (2.5 to 7.5%) and has a more physiological importance in the protection of the fruit than contributing to the nutritional value of the date flesh (Barreveld, 1993). The moisture content of date varieties with early time of maturity was high (25-34%) as reflected from their short shelf-life. Not large differences in sugar contents were observed between the ten varieties, the highest percentage was 83.32% in Taâbdount date flesh, whilst the lowest was found in Admam date flesh (61.64%). The mineral composition showed that K was the predominant mineral, followed in descending order by Mg and Fe. These results are in close agreement with the findings of Elleuch *et al.* (2008) for Deglet-Nour and Allig date palm fruit from Tunisia. The differences in chemical

**Table I: Proximate chemical composition of different varieties of dates**

| Samples | Aw | *Moisture (%) | *Ash (%) | *Protein (%) | *Lipid (%) | *Sugar (%) | Fe (mg/100 g) | K (mg/100 g) | Mg (mg/100 g) |
|---|---|---|---|---|---|---|---|---|---|
| Admam | 0.77±0.03 | 6.06± 1 | 2.67±0.02 | 2.53±0.3 | 0.46± 0.01 | 61.64±0.4 | 3.44 | 1376.4 | 96.737 |
| Afroukh ntijent | 0.70±0.06 | 5.53±0.2 | 3.01±0.01 | 3.1±0 | 0.2±0.09 | 70.74±0.6 | 3.087 | 1626.5 | 147.695 |
| Assiane | 0.66±0.01 | 14.5±0.1 | 2.8±0.02 | 2.6±0.1 | 0.23±0.03 | 74.04±0.5 | 32.763 | 1472.5 | 101.200 |
| Aziza bouzid | 0.66±0.02 | 19.26±0.2 | 2.17±0.03 | 2.9±0.05 | 0.17±0.05 | 71.71±0.55 | 3.988 | 1036.9 | 111.294 |
| Aziza manzou | 0.77±0.02 | 25±0.5 | 2.8±0.02 | 2.97±0.15 | 0.38± 0.02 | 68±0.26 | 5.282 | 792.11 | 99.246 |
| Boufeggous | 0.76±0.03 | 30±0.3 | 2.61±0.02 | 3.85±0.04 | 0.32±0.03 | 76.3±0.3 | 9.694 | 957.40 | 115.126 |
| Boufeggous gharas | 0.67±0.05 | 19±0.5 | 3.37±0.03 | 2.32±0.09 | 0.20±0.08 | 70±0.41 | 5.213 | 1358.9 | 215.549 |
| Taâbdount | 0.78±0.01 | 26±1.1 | 2.15±0.05 | 2.43±0.18 | 0.38±0.01 | 83.32±0.3 | 2.277 | 905.21 | 79.490 |
| Tadmamt | 0.71±0.01 | 27±1.2 | 3.46±0.01 | 3.5±0.2 | 0.1±0.09 | 63.94±0.6 | 6.793 | 876.45 | 92.959 |
| Tardbayt | 0.87±0.01 | 28±0.1 | 2.64±0.04 | 3.1±0.1 | 0.1±0.08 | 62.60±0.8 | _ | _ | _ |

All the given values are means of three determination ± standard deviation
*% on dry matter basis

**Table II: The microbiological profile of different varieties of dates**

| Samples | *TVC (cfu g-1) | Coliform (cfu g-1) | E.coli (cfu g-1) | Staphylococcus (cfu g-1) | Bacillus (cfu g-1) | **LAB (cfu g-1) | Yeasts (cfu g-1) | Moulds (cfu g-1) |
|---|---|---|---|---|---|---|---|---|
| Admam | 21 | 0 | 0 | 0 | 1 | 0 | 2 | 1 |
| Afroukh ntijent | 17 | 0 | 0 | 0 | 0 | 0 | 5 | 3 |
| Assiane | 45 | 0 | 0 | 1 | 5 | 0 | 4 | 3 |
| Aziza bouzid | 198 | 0 | 0 | 3 | 4 | 3 | 5 | 3 |
| Aziza manzou | 20 | 0 | 0 | 4 | 3 | 0 | 15 | 5 |
| Boufeggous | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Boufeggous gharas | 22 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| Taâbdount | 22 | 0 | 0 | 1 | 0 | 0 | 5 | 5 |
| Tadmamt | 4 | 0 | 0 | 4 | 3 | 1 | 1 | 1 |
| Tardbayt | 76 | 0 | 0 | 1 | 1 | 0 | 9 | 5 |

*Total Viable Counts, **Lactic Acid Bacteria

composition of date flesh may have several causes; firstly due to varieties. It is likely that local culture conditions and climatic conditions at the time of harvesting will affect the final composition of dates flesh.

**Microbiological composition:** The total viable counts (Table II), which are indices of the general microbiological quality, were low (in the range of $10^2$ cfu $g^{-1}$) except samples 2, 3 and 4. Coliform, Bacillus, Lactic acid bacteria and staphylococcus where not detected in any of the samples (<30 cfu $g^{-1}$). Yeasts and moulds were present in all the samples. Moulds are considered to be the major causative agent of the spoilage of date fruits at all stage of ripening on trees as well as during storage and processing. These findings are compatible with results of (Moore *et al*., 2001) for soft dates varieties grown in El Ahssae (Eastern Saudi Arabia). Due to high sugar content (61-83%) and low water activity (aw=<0.90) of all samples studied, except sample 10 with (aw=0.87), endogenous bacterial flora were unable to proliferate. Most of bacteria cannot grown when aw is reduced below 0.90 (Leistner and Rodel, 1975; Mossel, 1975; Acott *et al*., 1976). Below this value the production of toxin is also inhibited. Most yeast and moulds are inhibited for values of aw contained between 0.80 and 0.88. However certain, osmophilic yeasts are still able to develop as low aw as 0.60 (Scott, 1957; Poisson & Guilbot, 1963; Pitt, 1975).

Although the growth of microorganisms is influenced primarily by aw, the nature of the solutes also plays a role (Horner & Agnostopoulous, 1973). Aidoo *et al*. (1996), reported that pre-packed dates purchased in Glasgow contained high levels of coliform, yeasts and moulds and little or very low levels of *Staphylococcus aureus*. Moisture content is a critical parameter responsible for the microbiological quality of the dates. Shenasi *et al.* (2002) reported for dates from United Arabe Emirate, that microbial counts were high at the first (kimri) and second (rutab) stage of maturation, then decreased significantly at maturation stage, which had low water activity and high sugar content. It appears therefore, that presence of microflora in dates fruits may be dependent on the variety and the maturation stage.

## CONCLUSION

This study has provided baseline information on important date varieties grown in Figuig oasis of Morocco, in addition to revealing nutritionally important information on the major nutrient contents and importance of control of water activity to prevent microbiological contamination.

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## REFERENCES

Acott, K., A.E. Sloan and T.P. Labuza, 1976. Evaluation of antimicrobial agents in a microbial challenge study for an intermediate moisture dog. *Food. J. Sci.*, 41: 541–546

AFNOR, 2002. *Association Française de Normalisation (AFNOR)*, pp: 207–209. Norme française homologuée

Ahmed, I.A., A.K. Ahmed and R.K. Robinson, 1995. Chemical composition of date varieties as influenced by the stage of ripening. *Food Chem. J.*, 54: 305–309

Aidoo, K.E., R.F. Tester, J.E. Morrison and D. MacFarlane, 1996. The composition and microbial quality of prepacked dates purchased in Greater Glasgow. *Int. J. Food Sci. Technol.*, 31: 433–438

Al-Hooti, S., S. Jiuan and H. Quabazard, 1995. Studies on the physico-chemical characteristics of date fruits of five UAE cultivar at different stage of maturity. *Arab Gulf J. Scientific Res.*, 13: 553–569

Al-Shahib, W. and R.J. Marshall, 2002. Dietary fibre content of dates from 13 varieties of date palm *Phoenix dactylifera* L. *Int. J. Food Sci. Technol*., 37: 719–721

AOAC, 1990. *In*: Helrich, K. (ed.), *Official Methods of Analysis of the Association of Official Analytical Chemists*, 15th edition. A.O.A.C. Washington, DC

Barbin, P., 2006. *Contrôle et Elements De Maitrise De La Contamination Par La Levure Brettanomyces Au Cours Du Procedéde Vinification En Rouge*, p: 257. Thèse de doctorat de l'institut national polytechnique de toulouse, France

Barreveld, W.H., 1993. *Date Palm Products*, p: 216. FAO Agricultural Services Bulletin N°101. Food and Agriculture Organisation of the United Nations, Rome

Biglari, F., A.F.M. Alkarkhi and A.M. Easa, 2009. Cluster analysis of antioxidant compounds in dates *(Phoenix dactylifera)*: effect of long-term cold storage. *J. Food Chem.,* 112: 998–1001

Booij, I., G. Piombo, J.M. Risterucci, M. Coupe, D. Thomas and M. Ferry, 1992. Etude de la composition chimique des dattes à differents stades de maturité pour la caractérisation variétale de divers cultivars de palmier dattier (*Phoenix dactylifera* L.). *Fruits J.*, 47: 667–678

Dowson, V.H.W., 1982. *Date Production and Protection*. FAO Plant production and protection paper N°35. Food and Agriculture Organization of the United Nations, Rome

Ejlali, M., J. Carzouni Timssar and F. Badii, 1975. Etude sur les caractères biochimiques des dattes de variétés iraniennes; *Fruits J*., 30: 411–412

Elleuch, M., S. Besbes, O. Roiseux, C. Blecker, C. Deroane, N.E. Drira and H. Attia, 2008. Date flesh: chemical comosition and characteristics of dietary fibre. *J. Food Chem.,* 11: 676–682

Haddouch, M., 1996. Situation actuelle et perspective de développement du palmier dattier au Maroc. *Options Méditerrannéennes*, 28: 63–79

Horner, K.J. and G.D. Agnostopoulous, 1973. Combined effect of water activity, pH and température on the growth and spoilage potential of fungi. *J. Appl. Bacteriol*., 36: 427–436

Iqbal, M., A. Ghaffoor and S. Rehman, 2004. Effect of pollination times on frits characteristics and yield of date palm cv.Dhakki. *Int. J. Agric. Biol*., 6: 96–99

Ismail, B., I. Haffar, R. Baalabaki and J. Henry, 2008. Physico-chemical characteristics and sensory quality of two date varieties under commercial and industrial storage conditions. *LWT*., 41: 896–904

Leistner, L. and W. Rodel, 1975. The significance of water activity for microorganisms in meats. *In*: Duckworth, R.B. (ed.), *Water Relations in Foods*, pp: 309–323. *Academic Press*, New York

Moore, J.E., J. Cherie Millar, B. Xu, and S. Elshilbly, 2001. Edible dates (*Phoenix dactylifera* L.), a potential source of Cladosporium cladosporioides and sporobolomyces roseus: implication for public health. *Mycopathologica*, 154: 25–28

Mossel, D.A.A., 1975. *In*: Duckworth, R.B. (ed.), *Water and Microorganisms in Foods-a Synthesis-in Water Relations of Foods*, pp: 347–361. Acaemic Press, New York

Munier, P., 1973. *Le Palmier Dattier*, p: 220. G-P. Maisonneuvre et Larose, Paris, France

Paul, A.A. and D.A.T. Southgate, 1998. *McCance and Widdowson's The Composition of Foods*, 4th edition. London: HMSO

Pitt, J.I., 1975. *In*: Duckworth, R.B. (ed.), *Xerophilic Fungi and the Spoilage of Foods of Plant Origin: Water Relations of Foods*, pp: 273–307. Academic Press, New York

Poisson, J. and A. Guilbot, 1963. Storage conditions and the length of grain preservation. *Meun. Fr.*, 193: 19–29

Reynes, M., H. Bouabidi, G. Piombo and A.M. Risterucci, 1994. Caractérisation des principales variétés de dattes cultivées dans la région du djerid en Tunisie. *Fruits J.*, 49: 289–298

Sawaya, W.N., A.M. Miski, J.K. Khalil, A.A. Khatchadourian and A.S. Mashadi, 1983. Physicochemical characterisation of the major date varieties grown in Saudi Arabia. *Date Palm J.*, 2: 1–25

Scott, W.J., 1957. Water relation of food spoilage microorganisms. *Adv. Food. Res*., 7: 83

Shenasi, M., K.E. Aidoo and A.A.G. Candlish, 2002. Microflora of date fruits and production of aflatoxins at various stages of maturation. *Int. J. Food Microbiol*., 79: 113–119

Youssef, M.K.E., M.A.H. ElGueddawy, M.N. El-Rify and B.R. Ramadan, 1992. Study of amino acid, organic acid and free sugar composition of new valley dates and certain date products. *Acta Alimentaria*, 21: 325–335

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