



HAL
open science

Distribution of free amino acids, polyphenols and sugars of *Ziziphus jujuba* pulps harvested from plants grown in Tunisia

Meriem Elaloui, Abdelwahed Laamouri, Jean-François Fabre, Céline Mathieu, Gérard Vilarem, Brahim Hasnaoui

► To cite this version:

Meriem Elaloui, Abdelwahed Laamouri, Jean-François Fabre, Céline Mathieu, Gérard Vilarem, et al.. Distribution of free amino acids, polyphenols and sugars of *Ziziphus jujuba* pulps harvested from plants grown in Tunisia. *Natural Product Research*, 2015, 29 (1), pp.94-97. 10.1080/14786419.2014.959011 . hal-02534633

HAL Id: hal-02534633

<https://hal.science/hal-02534633>

Submitted on 7 Apr 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Open Archive Toulouse Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible

This is an author's version published in: <http://oatao.univ-toulouse.fr/25431>

Official URL: <https://doi.org/10.1080/14786419.2014.959011>

To cite this version:

Elaloui, Meriem and Laamouri, Abdelwahed and Fabre, Jean-François^{ORCID} and Mathieu, Céline^{ORCID} and Vilarem, Gérard^{ORCID} and Hasnaoui, Brahim
Distribution of free amino acids, polyphenols and sugars of Ziziphus jujubapulps harvested from plants grown in Tunisia. (2015) Natural Product Research, 29 (1). 94-97. ISSN 1478-6419

Any correspondence concerning this service should be sent to the repository administrator: tech-oatao@listes-diff.inp-toulouse.fr

Distribution of free amino acids, polyphenols and sugars of *Ziziphus jujuba* pulps harvested from plants grown in Tunisia

M. Elaloui^{a*}, A. Laamouri^a, J. Fabre^b, C. Mathieu^b, G. Vilarem^b and B. Hasnaoui^c

^a

Institut National des Recherches en Génie Rural, Eau, Forêts (INRGREF), rue Hedi Karray, Elmenzeh IV, BP 10, 2080 Ariana, Tunisia; ^b*Laboratoire de Chimie Agro-Industrielle (LCAI), UMR 1010 INRA-INPT/ENSIACET 4 allée Emile Monso 31030, Toulouse Cedex 4, France;* ^c*Institut Sylvo-pastoral de Tabarka, 8110 Tabarka, Tunisia*

Ziziphus jujuba pulps are very much appreciated by the inhabitants and have been recently exported. This article reports on the chemical composition (amino acids, polyphenols and sugars) of the pulps of four *Z. jujuba* ecotypes (Choutrana, Mahdia, Mahres and Sfax). The major amino acids identified were proline, aspartic acid and glutamic acid. Among these, proline was the most abundant amino acid (17.4 mol). Considerable differences in total phenolic contents (15.85 mg/L) were found. Predominant phenols identified by using HPLC were rutin (1.09 mg/L) and chlorogenic acid (2.57 mg/100 g). Sugars isolated from *Ziziphus* pulps were found at a rate of 43.52%. Using HPLC method, three sugars from the pulp extract were identified: glucose, galactose and sucrose. The Mahdia ecotype was the richest in these sugars with 0.45, 136.51 and 113.28 mg/L, respectively.

Keywords: *Ziziphus*; pulps; ecotype; amino acids; polyphenol; sugar; HPLC

1. Introduction

Ziziphus jujuba, known as Chinese jujube, is a highly valued plant native to China (Memon et al. 2012). The *Z. jujuba* fruit has multiple bioactivities (anticancer, anti-inflammatory, etc.), which was confirmed by Yu et al. (2012). Other studies were conducted on fatty acid compositions in the different parts of *Z. jujuba* plant (El Aloui et al. 2011, 2014). Amino acids ranged from 9.8/100 to 5.3/100 g in pulps and seeds, respectively (Suk-Hyun et al. 2011). Polyphenols extracted from *Z. jujuba* fruits ranged from 25 to 42 mg GAE/g (Kamiloglu et al. 2009). In Tunisia, some people have been using different parts (leaves, seeds, pulps) of the *Z. jujuba* plant in traditional medicines (tea, infusion, etc.). However, there have not been any studies on the chemical compositions of *Z. jujuba* fruits from Tunisia. Therefore, we examined the distribution of free amino acids and polyphenols in the pulps from four *Z. jujuba* ecotypes.

2. Results and discussion

2.1. Free amino acids

The typical GC profile (Chromatogram S1a and S1b) showed the existence of large variations in the amino acid contents between the four ecotypes (Sfax, Choutrana, Mahres and Mahdia). The major amino acid observed was proline at a level of 12.83 mol (Sfax ecotype) and 17.40 mol (Choutrana ecotype) of the total amino acids (Figure 1).

*Corresponding author. Email: maryoumaa2000@yahoo.fr

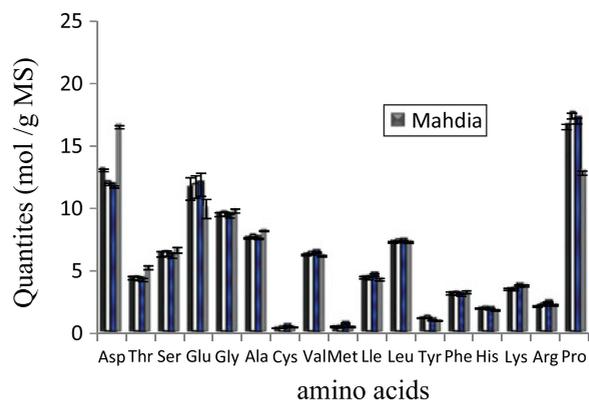


Figure 1. Free amino acids in the pulps of *Z. jujuba* ecotypes. The data are means values of three measurements. The confidence intervals were calculated at the threshold of 5%.

2.2. Phenolic compounds

The analysis of the total phenolic composition of *Z. jujuba* pulps varied from 10.43 mg/L (ecotype Mahres) to 15.85 mg/L (ecotype Sfax).

In Barbary fig, phenols were present in stems at the rate of 6.91 mg EAG/g (Rsaissi et al. 2013). Chlorogenic acid and rutin were detected as major phenolic compounds in the jujube pulps (Chromatogram S2). Chlorogenic acid ranged from 1.91 (Sfax ecotypes) to 2.57 mg/100 g (Choutrana ecotype). Rutin was detected in the levels of 0.16 and 1.1 mg/100 g in Mahres and Mahdia ecotypes, respectively.

In other species, such as *Ziziphus lotus* and *Ziziphus mauritiana*, the polyphenols were present at rates of 20.09 mg/g (Ghalem et al. 2014) and 12.8 mg/g (Memon et al. 2012) in roots and fruits, respectively. In comparison to other fruits, Soares et al. (2008) reported that the total content of insoluble phenolic acids in apple was between 11.08 g/g and 4.05 mg/g. In date seeds, this amount did not exceed 2.194 g/kg (Hosam et al. 2014). In *Ziziphus spina-christi* fruits, chlorogenic acid was the most predominant compound (6.20 ppm) (Amany et al. 2013).

This richness in polyphenols, with high pharmacological activities as radical scavengers (Cook & Samman 1996), can reduce the incidence of human diseases such as cancer and cardiovascular diseases. In addition, numerous studies investigated on the therapeutic roles of these compounds (antioxidant, anti-inflammatory, anti-stressful, anti-cancerous, antimicrobial, anti-allergic, anti-diabetic, etc.). Many authors (Ielpo et al. 2000; Petit et al. 2007) confirmed this. In plants, these natural active compounds may contribute to respiration, photosynthesis, cell growth, seeds germination and prevention of some diseases. Also, the polyphenols are responsible for fruit quality and nutritional value by modifying colour, taste, aroma, and flavour.

2.3. Sugar composition

The distribution of sugar yields in different ecotypes showed that the rate exceeded 43.52%, with the highest rate in the Mahdia ecotype. The HPLC profile showed the existence of large variation in sugar distributions in all ecotypes (Chromatogram S3). The major sugar observed was glucose at levels of 136.51% and 131.01% of the total sugar in Mahdia and Mahres ecotypes, respectively (Table S1). Sucrose was the major compound in the Mahdia ecotype (113.28%). Pareek (2013) found that *Z. jujuba* pulps contained 18.6% of fructose and 19.2% of glucose. In comparison to other fruits as mango, apples, dates total sugars ranged respectively from 11.16% (Doreyappa Gowda & Huddar 2001) to 12.6% (Funke & Blanke 2005) and 80%.

Information on the sugar composition of *Z. jujuba* pulps may be of great importance to consumers to implicate the jujubes in their diets as fruit juices, jams, cakes, etc. In fact, free sugars contribute to the nutritive property, the flavour and the sweet taste of many fruits such as apples, persimmon, berries and strawberries (Hirvi & Honkanen 1983).

4. Conclusion

Z. jujuba pulps are good sources of protein contents (especially proline and aspartic acid), phenolic compounds (especially rutin and chlorogenic acid) and sugars (glucose, sucrose and fructose). These high rates of extracts illustrate the importance of using the jujube pulps in cosmetics and pharmaceutical industries. *Z. jujuba* ecotype Sfax and ecotype Choutrana can be used as accessible sources of polyphenols and as a possible food supplement. Thus, many efforts and encouragements (enclosure and planting) should be set to allow the expansion of this endangered species. In addition, it is necessary to encourage the pharmaceutical and cosmetic industries to manufacture products based on jujubes.

Supplementary material

Experimental details relating to this paper are available online, alongside Table S1, Figure S1 and Chromatograms S1–S3.

References

- Amany MB, Shaker MA, Hoda AF. 2013. Utilization from fruits and leaves of Napek (*Zizyphus spina-christi* L.) as a source of bioactive components. *Int J Chem Nat Sci.* 1:29–36.
- Cook NC, Samman S. 1996. Review: flavonoids chemistry, metabolism, cardioprotective effects, and dietary sources. *J Nutr Biochem.* 7:66–76.
- Doreyappa Gowda IN, Huddar AG. 2001. Studies on ripening changes in mango (*Mangifera indica* L.) fruits. *J Food Sci Technol.* 38:135–137.
- El Aloui M, Laamouri A, Albouchi A, Cerny M, Mathieu C, Vilarem G, Hasnaoui B. 2014. Chemical compositions of the Tunisian *Zizyphus jujuba* oil. *Emir J Food Agric.* 26:602–608.
- El Aloui M, Mguis K, Laamouri A, Albouchi A, Cerny M, Mathieu C, Hasnaoui B. 2011. Fatty acids and sterols oils compositions of four Tunisian ecotypes of *Zizyphus zizyphus* (L.) H. Karst. *Acta Bot Gallica.* 159:25–31.
- Funke K, Blanke M. 2005. Can reflective ground cover enhance fruit quality and colouration? *Int J Food Agric Environ.* 3:203–206.
- Ghalem M, Merghache S, Belarbi M. 2014. Study on the antioxidant activities of root extracts of *Zizyphus lotus* from the western region of Algeria. *J Pharm.* 6:32–42.
- Hirvi T, Honkanen E. 1983. The aroma of some hybrids between highbush blueberry (*Vaccinium corymbosum* L.) and bog blueberry (*Vaccinium uliginosum* L.). *Lebensmittel Untersuchung.* 176:346–349.
- Hosam MH, Carine P, Emmanuelle M, Veronique C, Wissam HI. 2014. Polyphenolic compounds in date fruit seed (*Phoenix dactylifera*): characterisation and quantification by using UPLC-DAD-ESI-MS. *J Sci Food Agric.* 94:1084–1090.
- Ielpo MT, Basile A, Miranda R, Moscatiello VV, Nappo C, Sorbo S, Laghi E, Ricciardi MM, Ricciardi L, Vuotto ML. 2000. Immunopharmacological properties of flavonoids. *Fitoterapia.* 71:S101–S109.
- Kamiloglu O, Ercisli S, Sengul M, Toplu C, Serce S. 2009. Total phenolics and antioxidant activity of jujube (*Zizyphus jujube* Mill.) genotypes selected from Turkey. *Afr J Biotechnol.* 8:303–307.
- Memon A, Memon N, Luthria DL, Pitafi A, Bhangar MI. 2012. Phenolic compounds and seed oil composition of *Zizyphus mauritiana* L. fruit. *Pol J Food Nutr Sci.* 62:15–21.
- Pareek S. 2013. Nutritional composition of jujube fruit. *Emir J Food Agric.* 25:463–470.
- Petit P, Granier T, D'Estaintot BL, Manigand C, Bathany K, Schmitter JM, Lauvergeat V, Hamdi S, Gallois B. 2007. Crystal structure of grape dihydroflavonol 4-ruductase, a key enzyme in flavonoid biosynthesis. *J Mol Biol.* 368:1345–1357.
- Rsaissi N, Bouhache M, Bencharki B. 2013. Allelopathic potential of Barbary fig *Opuntia ficus-indica* (L.) Mill on the germination and growth of wild jujube *Zizyphus lotus* (L.) Desf. *Int J Innov Appl Stud.* 3:205–214.
- Soares TN, Chaves LJ, Telles MPC, Diniz-Filho JAF, Resende LV. 2008. Landscape conservation genetics of *Dipteryx alata*. *Genetica.* 132:9–19.

- Suk-Hyun Ch, Jun-Bae A, Nobuyuki K, Carol EL, Mendel F. 2011. Distribution of free amino acids, flavonoids, total phenolics, and antioxidative activities of jujube *Ziziphus jujuba* fruits and seeds harvested from plants grown in Korea. *J Agric Food Chem.* 59:6594–6604.
- Yu L, Jiang BP, Luo D, Shen XC, Guo S, Duan JA, Tang YP. 2012. Bioactive components in the fruits of *Ziziphus jujube* Mill. against the inflammatory irritant action of *Euphorbia* plants. *Phytomedicine.* 19:239–244.