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FULL LENGTH ARTICLE

The physico-chemical characteristics of Moroccan pomegranate and evaluation of the antioxidant activity for their juices[☆]

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Abstract The characteristics of pomegranate cultivars is important not only to put in evidence the diversity of varieties, but also to meet current market demand for quality fruits. The study was performed on a pomegranate collection from the National Institute for Agricultural Research experimental station, in a semi-arid climate. The aim of the current work was to study the morphological and biochemical characteristics and antioxidant capacity of eighteen pomegranate cultivars grown in Morocco. The results of fruit weight, aril percentage, seed percentage, and skin percentage were between 206.6–506.67 g, 56.45–69.41%, 9.36–18.56%, 22.09–42.60% respectively. This study showed that there were significant variations among the investigated cultivars for all measured parameters except aril length and seed weight. However, the results displayed that the values of total phenolic content varied from 1384.85 to 9476.32 mg GAE/L for local cultivars and from 1284.42 to 8295 mg GAE/L for foreign cultivars. These cultivars showed a high antioxidant capacity as high as 4577.12 ± 29.73 mg L⁻¹ juice and correlated with high phenol content. The result of morphological characteristics and chemical properties implies the great potential of pomegranate grown in Morocco for both fresh consumption and fruit processing. Additionally, the ‘Grenade

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[☆] Novelty statement: In Morocco, pomegranate fruits have taken notable attention for their antioxidant compositions in the last years. Because no previous research achieved in regard to pomological and Biochemical Traits for Moroccan genotypes. These descriptors based on morphological characteristic and biochemical, using polyphenol content, anthocyanin, condensed tannins, hydrolysable tannins and antioxidant activity (DPPH) showed that there were significant disparities among the studied cultivars in all measured parameters except aril length and seed weight. As described in this study, the morphological characteristics, antioxidant capacity and composition of phenolic compounds of pomegranate juices were influenced by the type of cultivar.

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jaune', 'Chioukh' and 'Gordo de Jativa' cultivars are suitable for the production of juices because of its high phenolic compositions.

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1. Introduction

The pomegranate tree has been grown in different regions such as the North Africa, Asia, the Middle East and the Mediterranean areas (Sarkhosh et al., 2006). The medicinal properties of this fruit, especially in traditional use, are known from time immemorial (Roy and Waskar, 1997). Morocco is among the main pomegranate producer countries. However, the pomegranate cultivation occupies an area of 5000 ha and provides an average yearly harvest of 58,000 tons fruit. Pomegranate arils are consumed as fresh fruit, but there are great efforts by industrial companies to convert a part of this production to juice. The consumption of processed pomegranate in Morocco has been increasing in the last ten years. However, there is not much work on the study of the antioxidant activity of pomegranate juice of Morocco. The major antioxidant activity of pomegranate juice was attributed to punicalagin, contained in the skin of fruit (Fuhrman et al., 2005). The commercial was prepared by pressing the whole fruit, which allows extraction of a large amount of bioactive compounds; therefore, commercial juices are reputed to have high antioxidant capacity.

Pomegranate has become more popular for the attribution of essential to human health such as anticancer (Afaq et al., 2005), HIV-1 entry inhibitory, cardioprotective (Sumner et al., 2005), and improve quality sperm (Türk et al., 2008). The edible parts of pomegranate fruit contain large amounts of organic acids, sugars, minerals, vitamins and polyphenols (Gil et al., 2000; Tehranifar et al., 2010).

In this context, the purpose of this study was to determine the physico-chemical characteristics and evaluate the antioxidant activity for 18 cultivars grown in Morocco in order to gain more knowledge about the pomegranate.

2. Materials and methods

2.1. Sample preparation

The study was performed in a pomegranate (*Punica granatum* L.) collection with 18 cultivars planted in 1996 (Table 1) at the INRA (National Institute for Agricultural Research) Experimental Station, Meknes-Morocco (altitude 500 m), which has a semi-arid climate. There is about 400 mm of rainfall per year. The soil is calcareous with a high percentage of clay. Trees are planted at 5 × 3 m spacing and irrigated at 3500 m³ per year supplied from May to October. The cultivars are cultivated under the same geographic conditions. However, no treatment is applied except removing old branches.

Twenty fruits of each cultivars were harvested at maturity in the beginning of October. All the cultivars studied had a similar maturity date, starting from the end of September to the beginning of October, this period induced by the staggered flowering of the tree.

Five fruits were harvested randomly from each of the four geographic orientations of the tree. The fruit was picked when

all greenness had disappeared from fruit peel surface. Then, they were immediately taken to the laboratory for analysis. The fruits were peeled and the skins covering arils were eliminated manually. Then, the juice was obtained from pomegranate arils by mechanical press, and was kept at (−20 °C) until achievement of assay. Three repeats were maintained for each analysis.

2.2. Chemicals and reagents

Potassium iodate, Folin–Ciocalteu reagent, sodium carbonate, Folin Denis reagent, potassium chloride, sodium acetate, and methanol were purchased from R&M Chemicals (Essex, UK). 1,1-Diphenyl-2-picrylhydrazyl (DPPH) was from the Fluka company (Switzerland). Trolox (6-hydroxy-2,5,7,8-tetra methylchroman-2-carboxylic acid), which is a hydrophilic analogue of vitamin E, Gallic and tannic acid were purchased from Sigma–Aldrich (St. Louis, MO, USA).

2.3. Physical characteristics

For each cultivar, twenty fruits were analyzed for physical characteristics. Fruits were weighted by using a balance of exactitude of 0.001 g. The length and diameter of the fruit and calyx were determined with a digital vernier caliper. The fruit length was performed as the polar axis, between the apex and the end of stem. The fruit diameter is defined as the maximum width of the fruit, and it was measured in the direction perpendicular to the polar axis. Then, the arils were extracted

Table 1 Origins geographic of eighteen pomegranate cultivars collected at the experimental station (National Institute for Agricultural Research) of Meknes-Morocco.

	Code	Name of variety	Origins geographic
Local	L1	Grenade jaune	Morocco
	L2	Grenade rouge	
	L3	Chioukhi	
	L4	Ounk Hmam	
	L5	Gjebali	
	L6	Djeibi	
	L7	Chelfi	
	L8	Bzou	
	L9	Sefri	
	L10	Sefri2	
Foreign	F1	Gordo de Jativa	Spain
	F2	Negro Monstrioso	Spain
	F3	Wonderful	USA
	F4	Ruby	USA
	F5	Dwarf semi Evergreen	USA
	F6	Mollar Osin Hueso	China
	F7	Zherie précoce	Tunisia
	F8	Zherie d'Automne	Tunisia

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