



Antioxidant potential of *Punica granatum* L., *Ficus carica* L. and *Phoenix dactylifera* L. fruits marketed in the Mostaganem region, Algeria

Nabil Bouziane^{1*}, Abdenour Benguendouz², Asma Bouterfa², Bedrani Elalia¹, Belmadah Ikram¹

¹Beneficial Microorganisms, Functional Food and Health Lab, Department of Food science, Faculty of natural and life sciences, University of Abdelhamid Ibn Badis, Mostaganem, 27000 Algeria.

²Applied Animal Physiology Lab, Faculty of natural and life sciences, Abdelhamid Ibn Badis University, Mostaganem 27000, Algeria.

*Email : bouzianenabil1978@gmail.com

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Abstract

The objective of this study was to evaluate and compare the antioxidant activity of pomegranate peel, date, and dried fig extracts using the DPPH radical-scavenging assay. All extracts exhibited antioxidant activity, with the following decreasing order: pomegranate peel > dates > dried figs. The high antioxidant activity of pomegranate peel may be attributed to its richness in phenolic compounds, particularly flavonoids and tannins. These findings highlight the potential of these fruit-derived materials, especially pomegranate peel, as valuable sources of natural antioxidants for nutritional and food applications.

Keywords: pomegranate peels, Dates, Dried figs; Polyphenol, Antioxidant activity.

1. Introduction

In recent years, oxidative stress represents a major public health concern. It results from an imbalance between the production of reactive oxygen species (ROS) and the antioxidant defense mechanisms of the body. When these protective systems become insufficient, the accumulation of free radicals causes damage to lipids, proteins, and DNA, thereby contributing to the development of numerous chronic diseases, including cardiovascular diseases, diabetes, neurodegenerative diseases, several types of cancers, as well as cellular aging (Favier, 2003; Halliwell and Gutteridge, 2007).

In response to this issue, natural antioxidants have attracted increasing interest because of their ability to neutralize free radicals and mitigate the effects of oxidative stress. Fruits and their by-products represent an important source of bioactive compounds, such as polyphenols, flavonoids, tannins, and anthocyanins, which are recognized for their antioxidant, anti-inflammatory, and protective properties (Lansky and Newman, 2007; Seeram et al., 2006).

The utilization of these natural resources is currently considered a promising approach for the development of functional foods and products with nutritional and therapeutic potential. Algeria has a rich and diverse fruit heritage, including pomegranate (*Punica granatum* L.), date (*Phoenix dactylifera* L.), and fig (*Ficus carica* L.), three fruits that are widely consumed and valued for their nutritional properties. Pomegranate is particularly recognized for the richness of its peel in polyphenols, especially ellagitannins, whereas dates and figs are excellent sources of dietary fiber, vitamins, minerals, and numerous phenolic compounds (Al-Farsi and Lee, 2008; Wojdylo et al., 2016; Lansky and Newman, 2007).

Despite their biological potential, specific parts of these fruits, such as pomegranate peels, remain insufficiently valorized, even though they contain high concentrations of bioactive molecules. In this context, assessing the antioxidant potential of these fruits is of considerable scientific, nutritional, and economic interest. Among the most widely used methods for measuring antioxidant activity is the DPPH assay (2,2-diphenyl-1-picrylhydrazyl), which allows the ability of plant extracts to scavenge free radicals and prevent oxidation processes to be evaluated (Brand-Williams et al., 1995).

Based on these findings, the main objective of this study is to evaluate and compare the antioxidant activity of extracts from pomegranate peels, dates, and dried figs using the DPPH method, in order to identify the natural source exhibiting the highest antioxidant potential and to highlight their nutritional and therapeutic value.

Materials and Methods Plant Material The plant materials used in this experiment were pomegranate (*Punica granatum* L.), dried fig (*Ficus carica* L.), and date (*Phoenix dactylifera* L.), which are widely consumed in Algeria due to their availability, pleasant taste, and richness in nutrients and bioactive compounds. The samples used in this study were purchased from a public market known for its high consumer traffic. The study focused on pomegranate peels, whole dates, and dried figs. The

pomegranate peels were collected and then air-dried. After complete drying, they were ground and sieved to obtain a fine and homogeneous powder. The dates were carefully washed to remove impurities and then dried before being ground. The resulting powder was subsequently sieved to ensure uniform particle size. The dried figs were used as such; they were ground and then reduced to a fine powder after sieving. The powder obtained from each sample (pomegranate peels, dates, and dried figs) was stored and packaged in appropriate containers, with 10 g of powder per container. Finally, the different powders were transported to the Biochemistry Laboratory of Abdelhamid Ibn Badis University of Mostaganem, Algeria, for subsequent use.

2. Determination of the Antioxidant Activity of Each Powder Using the DPPH Method Preparation of the Stock Solution of Each Sample

For each sample (pomegranate peel, date, and dried fig), 1 g of powder was accurately weighed and transferred into a clean tube containing 10 mL of methanol. The mixture was shaken and left to macerate for 24 hours at room temperature to allow the extraction of antioxidant compounds. After extraction, the mixtures were filtered using Whatman filter paper to remove solid particles and obtain clear extracts for the determination of antioxidant activity.

For each extract, five concentrations were prepared: 0.2, 0.4, 0.6, 0.8, and 1.0 mg/mL. The determination of antioxidant activity was carried out according to the method described by **Benhammou et al. (2007)**, with some modifications. Then, in a test tube, 1 mL of the methanolic extract from each sample was mixed with 1 mL of DPPH solution (0.1 mM). The mixture was then homogenized and incubated in the dark for 30 min at room temperature. A control was prepared by replacing the extract with 1 mL of methanol mixed with 2 mL of DPPH solution. Finally, the absorbance was measured at 517 nm using a UV-Visible spectrophotometer. The inhibition percentages obtained were used to compare the antioxidant potential of the different extracts and to identify the sample exhibiting the highest antioxidant activity.

3. Results

The results obtained from this study allowed the antioxidant activity of the different extracts to be evaluated and are presented in Table 1 below. The antioxidant activity of the pomegranate peel, date, and dried fig extracts was determined at different concentrations by measuring their ability to inhibit the DPPH radical. The absorbance values recorded at 517 nm were used to calculate the corresponding inhibition percentages.

Concentration (mg/mL)	0,2	0,4	0,6	0,8	1
Antioxidant Effect of the Extracts (%)					
Pomegranate Peel Extract	35,7	51,1	65	76.1	84.9
Date Extract	22.5	33.8	45	56.2	66.2
Dried Fig Extract	15	26.1	37.3	47.4	57.4

The results show a progressive increase in the inhibition percentage with increasing extract concentration. At the maximum concentration of 1 mg/mL, the pomegranate peel extract exhibited an inhibition percentage close to 85%, thus indicating a very strong antioxidant activity. This high activity is probably related to the richness of pomegranate peels in polyphenols, hydrolyzable tannins, and flavonoids, compounds known for their powerful antioxidant properties. Regarding the date extract, it also exhibited an increasing antioxidant activity with increasing concentration, with a maximum inhibition percentage of 66.2% at a concentration of 1 mg/mL. However, the values obtained remained lower than those recorded for the pomegranate peel extract. This antioxidant activity may be attributed to the presence of phenolic compounds, flavonoids, and carotenoids, which are known for their antioxidant properties. The dried fig extract also exhibited concentration-dependent antioxidant activity. The lowest activity (15%) was recorded at a concentration of 0.2 mg/mL, whereas the maximum inhibition was recorded at a concentration of 1 mg/mL, with an inhibition percentage of approximately 57.4%. However, the inhibition percentages obtained were the lowest among the three samples studied. This difference could be related to a lower content of phenolic compounds or to the lower effectiveness of the antioxidant molecules present in figs against the DPPH radical.

4. Discussion

The results obtained using the DPPH method revealed variable antioxidant activity among the extracts investigated. For all samples, the percentage of DPPH radical inhibition progressively increased with increasing extract concentration, indicating a dose-dependent relationship between the concentration of bioactive compounds and antioxidant capacity. This trend is consistent with the findings of **Brand-Williams et al. (1995)**, who demonstrated that the DPPH assay can be used to evaluate the ability of antioxidant molecules to donate electrons or hydrogen atoms in order to neutralize free radicals. Pomegranate peels exhibited the highest inhibition values at all concentrations tested. At a concentration of 1 mg/mL, the mean inhibition percentage reached 84.9%, indicating very strong antioxidant activity. This result is similar to that reported by **Seeram et al. (2005)**, who showed that pomegranate peel extracts exhibit antioxidant activity exceeding 80% due to their high content of punicalagins, ellagitannins, and other polyphenols. Similarly, **Elfalleh et al. (2012)** reported that methanolic extracts of pomegranate peels exhibit strong DPPH radical-scavenging activity. According to **Li et al. (2006)**, pomegranate peels contain

phenolic compounds at concentrations several times higher than those found in the pulp, which explains their remarkable antioxidant capacity. Therefore, the results of the present study are consistent with those reported in the literature. Regarding dates, the results obtained showed an intermediate antioxidant activity, with a maximum inhibition percentage of 66.2% at 1 mg/mL. This result is close to that reported by **Al-Farsi and Lee (2008)**, who reported values ranging from 55 to 75% depending on the varieties studied. Similarly, **Biglari et al. (2008)** demonstrated that methanolic date extracts exhibit significant antioxidant activity due to their high content of phenolic compounds, flavonoids, and carotenoids. The differences observed between our study and those reported by other authors may be related to the date variety, maturity stage, climatic conditions, geographical origin, as well as the extraction procedure used. Indeed, **Al-Farsi et al. (2005)** demonstrated that the phenolic compound content varies considerably among different date cultivars.

Dried figs exhibited the lowest inhibition percentages among the three extracts studied, with a maximum value of 57.4% at 1 mg/mL. These results are comparable to those reported by **Solomon et al. (2006)** and **Veberic et al. (2008)**, who demonstrated moderate antioxidant activity in figs, mainly attributed to the presence of flavonoids, anthocyanins, and phenolic acids. According to **Wojdylo et al. (2016)**, drying figs may lead to a partial reduction in certain heat-sensitive phenolic compounds, which could explain the relatively low values observed in our study.

Differences between the results may also be attributed to drying conditions, storage conditions, as well as the variety of figs studied. Regarding the evolution of the inhibition percentage, it was observed that the antioxidant activity followed the order pomegranate peels > dates > dried figs. This order was observed at all concentrations tested and confirms the superior antioxidant activity of pomegranate peels. Similar results have been reported by **Seeram et al. (2005)** and **Elfalleh et al. (2012)**, who showed that pomegranate peels possess a polyphenol content considerably higher than that of many other fruits. According to **Conforti et al. (2011)**, there is a positive correlation between the content of phenolic compounds and the antioxidant capacity of plant extracts, which may explain the differences observed among the three fruits studied. Overall, the results obtained confirm the nutritional and therapeutic potential of the fruits studied as natural sources of antioxidants.

The high antioxidant activity observed for pomegranate peels suggests that this agro-industrial by-product could be valorized in the pharmaceutical, nutraceutical, and food industries as a source of natural antioxidants. Dates and figs also represent valuable resources that may contribute to the prevention of the effects of oxidative stress, which is involved in numerous chronic diseases, particularly cardiovascular diseases, diabetes, neurodegenerative diseases, and some cancers.

5. Conclusion

In conclusion, this study highlights the importance of the fruits investigated as natural sources of antioxidants and particularly emphasizes the value of pomegranate peels, which are often considered an agro-industrial by-product. Their strong antioxidant activity offers promising prospects for their valorization in the food, pharmaceutical, and nutraceutical industries. Further studies focusing on the identification and quantification of the phenolic compounds responsible for this activity would provide a deeper understanding of their biological properties and potential applications.

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