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Antioxidant effects of four native medicinal plants collected in Córdoba

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ABSTRACT

The antioxidant capacity of *Thelesperma megapotamicum* (Spreng.); *Microliabum candidum* (Griseb.) H. Rob; *Capparis atamisguea* Kuntze, and *Ligaria cuneifolia* (Ruiz et Pav.) Tiegh. were evaluated using two in-vitro systems. Aerial parts of the plants were collected within the Province of Córdoba, air-dried, and stored until needed. The FRAP method and an accelerated oil oxidation system were used to evalutae the antioxidant effects on the 4 native plants. BHT and quercetin were included as antioxidant control compounds. Results (FRAP) showed that C. atamisguea had the lowest value of antioxidant capacity (122 μmol of Fe (II)/g) while L. cuneifolia the highest (1995 μmol of Fe (II)/g) even higher that BHT antioxidant capacity. The use of an oxidation system showed that native plants from Córdoba could be a source for novel natural antioxidant compounds for use in the food industry.

Keywords: antioxidant activity, native plants, Córdoba, Argentina

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Introduction

Antioxidants have been detected in a number of agricultural and food products including cereals, fruits, vegetables and oil seeds. (Adom et al, 2003; Naczk and Shahidi, 2006 ; Netzel et al, 2007). Superoxide radicals (O2-), hydroxyl radical (.OH), and peroxyl radicals (ROO.), have been associated with heart disease and carcinogenesis (Steer et al 2002). Antioxidants are increasingly being recommended because they act directly on oxidative processes and may be a method to prevent diseases ad health problems related to aging. Thus, there is a constant search for antioxidant natural resources and isolation of antioxidant biomolecules.

Foods, especially processed food, may experience deterioration due to oxidative reactions. Traditionally, synthetic antioxidants such as butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), and propyl gallate (PG) have been widely used as antioxidants in the food industry (Nawar, 1996). However, these have been reported to be carcinogenic and mutagenic (Ito et al., 1986).

Native medicinal plants may offer excellent source of natural antioxidant bioactive compounds to be employed as dietary supplements or as antioxidants for the food industry. The objective of this work was to evaluate the antioxidant activities of four non-cultivated (wild) native medicinal plants growing in the Province of Córdoba (between 29o30´-35o SL and 61°47´and 65°46' WL) in Argentina.

Experimental

Materials: Samples of four medicinal plants *(Thelesperma megapotamicum* (Spreng.); *Microliabum candidum* (Griseb.) H. Rob; *Capparis atamisguea* Kuntze, and *Ligaria cuneifolia* (Ruiz et Pav.) Tiegh.) were collected and authenticated by a botanist (Cantero, J.J). Aerial parts of the plants were air-dried (25–30 °C), grounded to fine powder, and stored on tight-seal dark plastic containers until needed.

Extract preparation: 1.5% ethanol (70%) extracts were prepared

Antioxidant activity analysis: The ferric reducing/antioxidant power (FRAP) assay of Benzie and Strain (1996) was used to measure in-vitro plant extracts antioxidant activities. Also, a fish oil accelerated oxidation process (60°C, 10 days) was used to evaluate the antioxidant capabilities of plant extracts. The conjugated diene-hydroperoxides (CDH) and the thiobarbituric acid-reactive substances (TBARS) (Madesen et al, 1998) assays were used to follow-up the oxidation of fish oil.

Total phenols determination: Total phenols were determined by the Folin–Ciocalteau method (Orthofer and Lamuelas-Raventos, 1999).

Table 1. Antioxidative capacity of ethanolic extracts and phenol content of four native medicinal plants collected in Cordoba[1]

Botanical name	FRAP, ferric reducing antioxidant powerb[2]	Total phenols (mg GAE/g)[3]
Capparis atamisguea Kuntze	122±21	12±2
Microliabum candidum (Griseb.)H. Rob	525±35	45±11
Thelesperma megapotamicum (Spreng.)	580±19	42±7
BHT	1589±54	-
Ligaria cuneifolia (Ruiz et Pav.) Tiegh.	1995±48	122±10
Quercetin	13283±122	-

[1]Mean values (n = 3). For clarity purposes standard deviations (SD) have been omitted. [2]Values expressed as μmol of Fe (II)/g ; [3]mg GAE/g – milligram gallic acid equivalents per g of sample.

Results and discussion

FRAP antioxidant activity

Table 1 shows the in-vitro antioxidant capabilities ad the total phenols content of ethanol extracts obtained from the four native medicinal plants analyzed.

For comparative purposes we measured the antioxidant activity of a widely used synthetic antioxidant (BHT) and a natural antioxidant (quercetin). It can be observed that quercentin has the highest antioxidant activity as measured by FRAP method. Of the analyzed plants, *Capparis atamisguea* had the lowest antioxidant activity *(*122±21) while *Ligaria cuneifolia* the highest *(*1995±48), even higher than the traditional synthetic BHT antioxidant (1589±54) commonly used by the food industry. Table 1 also shows that the antioxidant capacity are generally directly

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associated with the total phenol content. Many studies have found a significant positive correlation between antioxidant capacity and phenols content (Silva et al., 2007).

Formation of TBARS and inhibition of CDH

Oxidative processes in food systems can be followed by measuring TBARS formation and CDH inhibition. Lipid oxidation is a complex process that starts with a free radical (formed by a prooxidant or by action of light). This free radical formation set a chain of events that leads to formation of conjugated diene-hydroperoxides and hydrperoxides in general. When fish oil is heated for 10 days at 60°C oxidation of fatty acids is induced. After 10 days under these harsh conditions total TBARS is 4.8 times more than initially. When BHT is added to fish oil TBARS formation is only 1.6 times of initial content. This reduction from 4.8 to 1.6 denotes the antioxidant activity of BHT. TBARS content of fish oil containing 0.1% of plant extracts were 1.8, 1.9, 2.3, and 3.8 times for *T. megapotamicum, M. candidum, L. cuneifolia, and C. Atamisguea*, respectively. These results shows that plant extracts had antioxidant activities in fish oil that in some cases were very similar to the BHT (although BHT was at 0.01% concentration and plant extracts at 0.1%). Similar antioxidant effects were observed when the inhibition of CDH was used to measure oxidation (data not shown).

Conclusion

The results in this investigation has shown that medicinal plants may be good source of natural antioxidants. This preliminary work encourages us and others to continue investigating the potential antioxidant use of the native medicinal plants present in Córdoba.

Note: Part of this study was presented at the 'II Reunión de Biotecnología aplicada a plantas medicinales y aromáticas' (Second Biotechnology Meeting on Medicinal and Aromatic Plants), Córdoba, Argentina, 2009.

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