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Polyphenols and antioxidant capacity of Bulgarian medicinal plants

D. Ivanova*, D. Gerova, T. Chervenkov, T. Yankova

Department of Pharmacology and Biochemistry, University of Medicine Varna, 55 Marin Drinov Street, 9002 Varna, Bulgaria

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Abstract

Extracts of 21 plants used in Bulgarian phytotherapy for the treatment of respiratory, gastrointestinal and other inflammatory disorders were screened in vitro for antioxidant activity and phenolic compounds content. Plant extracts were prepared as herbal teas following the ethnic use. The water-phase TEAC (Trolox equivalent antioxidant capacity) of the teas were compared to that of the famous tea-like beverages mate, rooibos and honeybush, and to that of green and black tea, well known for their high antioxidant potential. The content of total phenolics in the teas was determined spectrometrically according to the Folin-Ciocalteu procedure and calculated as quercetin equivalents (QE). Seven Bulgarian medicinal plants were with high phenolics content and antioxidant properties: *Pulmonaria officinalis* L. (*Boraginaceae*) (TEAC 2.02 ± 0.14 mM/QE 673.39 ± 9.92 μM), *Hypericum perforatum* L. (*Hypericaceae*) (TEAC 3.75 ± 0.14 mM/QE 881.93 ± 6.68 μM), *Agrimonia eupatoria* L. (*Rosaceae*) (TEAC 3.76 ± 0.5 mM/QE 702.29 ± 6.82 μM), *Origanum vulgare* L. (*Lamiaceae*) (TEAC 5.87 ± 0.2 mM/QE 1653.61 ± 11.52 μM), *Melissa officinalis* L. (*Lamiaceae*) (TEAC 4.06 ± 0.31 mM/QE 1370.09 ± 41.38 μM), *Rubus* sp. *diversa* (*Rosaceae*) (TEAC 4.23 ± 0,12 mM/QE 608.95 ± 5.95 μM), *Cotinus coggygria* Scop. (*Anacardiaceae*) (TEAC 7.05 ± 0.19 mM/QE 923.33 ± 14.19 μM). Therefore, Bulgarian herbs can be considered to be a rich source of water-soluble antioxidants and/or phenolic compounds as compared to studied foreign plants.

Keywords: Antioxidants; Total phenolics; Tea; Medicinal plants; Traditional medicine

1. Introduction

Various medicinal properties have been ascribed to natural herbs. Medicinal plants constitute the main source of new pharmaceuticals and healthcare products, including medications for ethnoveterinary medicine. A whole range of plant-derived dietary supplements, phytochemicals and pro-vitamins that assist in maintaining good health and combating disease are now being described as functional foods, nutriceuticals and nutraceuticals. Plant-derived products are also increasingly accepted and used in the cosmetic industry.

The widespread use of traditional herbs and medicinal plants has been traced to the occurrence of natural products with medicinal properties. The roles of herbal tea in disease prevention and cure have been attributed, in part, to antioxidant properties of their constituents-liposoluble vitamins A and E, the water soluble vitamin C, and a wide range of amphipathic molecules, broadly termed phenolic compounds. The antioxidant activity of phenolics is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donators, singlet oxygen quenchers, and metal chelators (Rice-Evans et al., 1997; Morel et al., 1994).

Bulgaria constitutes an apt example where medicinal plants are widely used in everyday life as part of folk medicinal remedies. Bulgarian flora is remarkable for its diversity and it is a rich source of medicinal plants – 600 out of 3500 plant species are known to be medicinal (Ahtarov, 1939; Kitanov, 1953; Stojanov et al., 1967; Iordanov et al., 1969;

* Corresponding author. Tel.: +359 52 606 786x322; fax: +359 52 650 019.
E-mail addresses: dgiva@mu-varna.bg, dgiva@muvar.acad.bg (D. Ivanova).

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Dimkov, 1979; Petkov, 1982). However, it is still needed to explore the usefulness of many of them for modern therapy. Little is known about the antioxidant potential of Bulgarian medicinal plants. The aim of this study is to establish the antioxidant capacity and phenolic content of some of the most popular medicinal plants in comparison to four plants used all over the world to prepare tea: mate, rooibos, honeybush, and green and black tea.

2. Methods and materials

2.1. Selection of plants

Amongst the 600 different species known to be medicinal in Bulgaria we chose to study 21 species that are most widely used in the everyday life of the population (Table 1). We selected the species on the basis of their traditional in-

Table 1
Medicinal plants used in Bulgarian phytotherapy

Plant	Common name	Part of plant tested	Medical use/disease treated
Anacardiaceae			
Cotinus coggygria Scop.	Smoke tree	Leaves	Gastric and duodenal ulcer, antidiarrhetic, anti-inflammatory agent, paradontosis
Asteraceae			
Cichorium intybus L.	Chicory, Wild succory	Roots	Cholagogue, energizer of gastric secretion
Matricaria chamomilla L.	Chamomile	Flowers	Choleretic, gastric ulcer, gastritis, colitis, diseases of the respiratory tract, antiseptic for the mouth and throat
Taraxacum officinale complex	Common dandelion	Aerial parts	Cholagogue, choleretic
Boraginaceae			
Pulmonaria officinalis L.	Lung-wort	Leaves	Antitussive, expectorant
Brassicaceae			
Capsella bursa-pastoris (L.) Medik.	Shepherd's purse	Aerial parts	Uterotonic, coagulant
Ericaceae			
Arctostaphylos uva-ursi (L.) Spreng.	Bearberry	Leaves	Uroantiseptic
Cannabiaceae			
Humulus lupulus L.	Hop	Flowers	Sedative, menstrual disorders
Hypericaceae			
Hypericum perforatum L.	Common St John's wort	Aerial parts	Gastric and duodenal ulcer, regenerative, anti-inflammatory agent in digestive tract diseases, epithelotonic
Lamiaceae			
Lavandula angustifolia Mill.	Lavender	Flowers	Sedative, spasmolytic
Melissa officinalis L.	Common balm	Leaves	Sedative, hypotensive, spasmolytic
Mentha piperita L.	Peppermint	Leaves	Indigestion, jaundice, liver diseases, gastric disorders
Origanum vulgare L.	Wild majoram	Aerial parts	Antitussive, expectorant, sedative, choleretic, cholagogue
Sideritis scardica Griseb.	–	Leaves, flowers	Expectorant, pulmonary emphysema, urogenital diseases, immunostimulant
Parmeliceae			
Cetraria islandica (L.) Ach.	Iceland moss	Thalus	Expectorant, anti-inflammatory agent in respiratory and digestive tract diseases, appetizer
Plantaginaceae			
Plantago major L.	Great plantain, Common plantain	Leaves	Expectorant, anti-inflammatory agent in respiratory and digestive tract diseases
Rosaceae			
Agrimonia eupatoria L.	Common agrimony	Aerial parts	Astringent, antidiarrhetic, anti-inflammatory agent in urinary diseases and liver
Crataegus monogyna Jacq.	Hawthorn	Leaves, flowers	Cardiovascular diseases, myocarditis, ischemia, antidiarrhetic
Rubus sp. *diversa*	Blackberry, Black raspberry	Leaves	Astringent, antidiarrhetic, anti-inflammatory
Tiliaceae			
Tilia platyphyllos Scop.	Common lime	Flowers	Expectorant, anti-inflammatory agent in respiratory tract diseases, sedative, antipyretic
Verbenaceae			
Verbena officinalis L.	Common vervain	Aerial parts	Antipyretic, sedative