

Antioxidant Activity of *Coleus Blumei*, *Orthosiphon Stamineus*, *Ocimum basilicum* and *Mentha arvensis* from Lamiaceae Family

Zuraini ZAKARIA¹ Rais AZIZ¹ Yoga Latha LACHIMANAN³ Sasidharan SREENIVASAN^{2,3*} Xavier RATHINAM²

¹ Biology Section, School of Distance Education, Universiti Sains Malaysia, Minden 11800, Penang, MALAYSIA

² Department of Biotechnology, Faculty of Applied Sciences, Asian Institute of Medicine, Science and Technology, 08000 Sungai Petani, Kedah, MALAYSIA.

³ School of Biological Sciences, Universiti Sains Malaysia, Universiti Sains Malaysia, Minden 11800, Penang, MALAYSIA

* Corresponding Author
e-mail: srisasidharan@yahoo.com

Received: September 24, 2007

Accepted: November 12, 2007

Abstract

A groups of Lamiaceae plants namely *Coleus blumei*, *Orthosiphon stamineus*, *Ocimum basilicum* and *Mentha arvensis* were collected from Penang, Malaysia were screened for their *in vitro* antioxidant activity. Stems and leaves of selected plants were dried at 45 °C and powdered. Then, extraction was performed with methanol. By employing DPPH (2,2-diphenyl-1-picrylhydrazyl radical) scavenging assays, it was shown that all the methanol extracts of the samples collected were endowed with antioxidant activity, though, as expected, their potency varied according to the different parts and species. In particular, leaves and stems of *Ocimum basilicum* displayed the highest activity. The IC₅₀ value of the extracts tested were ranged from 0.181 mg/mL - 2.85 mg/mL. It is generally accepted that a diet rich in plants is associated with a reduced incidence of degenerative diseases, such as atherosclerosis and cancer. This study suggests that the Lamiaceae plants could be pharmaceutically exploited for antioxidant properties.

Key words: Antioxidant activity, DPPH radical scavenging assay, Lamiaceae

INTRODUCTION

Free radicals are potentially important in a number of ailments states that can have severe effects on the cardiovascular system, either through lipid peroxidation or vasoconstriction [1]. Although the antioxidant defense systems includes both endogenously and exogenously derived compounds, dietary plants based antioxidant have recently received a great attention [2]. Hence many studies have been performed to identify antioxidant compounds with pharmacological activity and a limited toxicity from medicinal plants. In this context, ethnopharmacology plays a significant part in the search for interesting and therapeutically useful plants. In order to contribute to the knowledge of plants from Malaysia, in the present study, 4 medicinal plants species from Lamiaceae family namely *Coleus blumei*, *Orthosiphon stamineus*, *Ocimum basilicum* and *Mentha arvensis* were screened to determine their free radical scavenging and antioxidant activities.

The plants grouped in Lamiaceae are important and many are of great economic importance. They are widely used in traditional systems of medicine and horticulture. The Lamiaceae plants are herbs shrubs, or trees comprising about 258 genera and 6,970 species, commonly with aromatic, herbage, quadrangular stems, and verticillate inflorescences. The leaves are usually opposite or whorled, and are simple or occasionally pinnately compound; stipules are absent. Hence, the aim of the present studies was to evaluate and to compare the antioxidant activity amongst the Lamiaceae plants according to the species and parts of the plants.

MATERIAL AND METHODS

Plant collection and extraction

Samples of four different plants species of Lamiaceae family namely *Coleus blumei*, *Orthosiphon stamineus*, *Ocimum basilicum* and *Mentha arvensis* were collected from Penang, Malaysia, in September of 2006. Plants were identified by a botanist of School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia. Leaves and stems of selected plants were dried (45 °C) and powdered with a mortar.

Preparation of plant extracts

Some 100g of dried and powdered plant material were extracted at room temperature with 500 mL of methanol under constant shaking for 24 h. After filtration, the methanolic (MeOH) solutions were evaporated to dryness in a rotary evaporator for the biological assays.

DPPH scavenging test

Quantitative measurement of radical scavenging properties was carried out in a universal bottle. The reaction mixture contained 50 µL of test samples (or 80% MeOH as a blank) and 5 mL of a 0.004% (w/v) solution of DPPH in methanol. Different known antioxidants, vitamin E, and butylated hydroxytoluene (BHT, Sigma) were used for comparison or as a positive control. Discoloration was measured at 517 nm after incubation for 30 min. Measurements were taken at least in triplicate. DPPH radical's concentration was calculated using the following equation:

$$\text{DPPH scavenging effect (\%)} = \frac{A_0 - A_1}{A_0} \times 100$$

Where A_0 was the absorbance of the control and A_1 was the absorbance in the presence of the sample [3] (crude extract of Lamiaceae plants). The actual decrease in absorption induced by the test compounds was compared with the positive controls. The mean OD_{517} results of DPPH scavenging against the logarithms of concentrations were plotted using the Microsoft Excel computer program, which also presents regression equations. The regression equations were used to calculate the IC_{50} value.

RESULTS AND DISCUSSION

There is a strong need for effective antioxidants from natural sources as alternatives to synthetic antioxidant in order to prevent the free radicals implicated diseases which can have serious effects on the cardiovascular system, either through lipid peroxidation or vasoconstriction [1, 4]. The extracts and essential oils of many plants have been investigated for their antioxidant activity [5-7]. Secondary metabolites such as polyphenols are not required for plant development and growth, but are involved in plant communication and defense [8-9]. Polyphenols interact with pathogens, herbivores, and other plants; they protect from ultraviolet radiation and oxidants, repel or poison predators and attract beneficial insects or microbes [10-11].

Therefore, in this study, the antioxidant properties of the methanol extracts of leaves and stems of plants of Lamiaceae family from Malaysia; *Coleus blumei*, *Orthosiphon stamineus*, *Ocimum basilicum* and *Mentha arvensis* were examined for DPPH radical scavenging activity according to the method described and the results of the screening are shown in Figure 1 to Figure 4 as comparable with known antioxidant BHT. In terms of antioxidant activity, all the extracts investigated exhibited a rather high degree of activity (more than 40%). In particular, species of *Ocimum basilicum* displayed the highest activities as antioxidant activity as removal of the stable radical DPPH (Figure 1) and the lowest activity were found in *Coleus blumei*. As expected, the overall activity of the raw extracts was lower than that of commercial antioxidant BHT, the reference antioxidant (Figure 1 to Figure 4). In other words, *Coleus blumei* showed the lowest antioxidant activity, followed by *Orthosiphon stamineus*, *Mentha arvensis* and *Ocimum basilicum*, in increasing order.

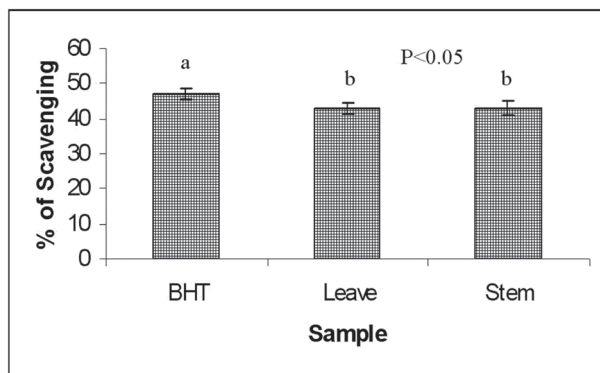


Figure 1. Scavenging effect (%) of crude extract of *Mentha arvensis* and known antioxidant BHT, at 1.0 mg/mL

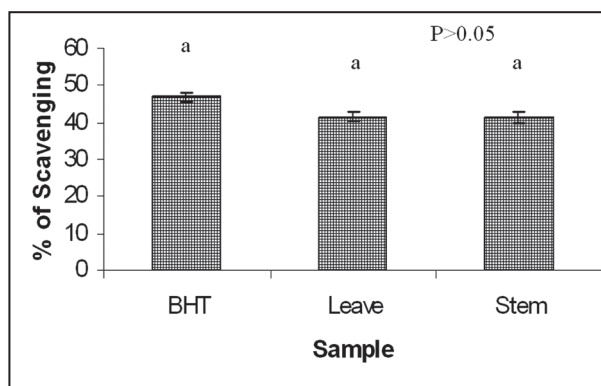


Figure 2. Scavenging effect (%) of crude extract of *Orthosiphon stamineus* and known antioxidant BHT, at 1.0 mg/mL

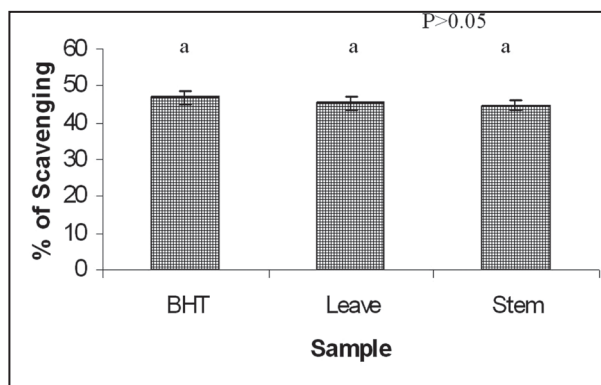


Figure 3. Scavenging effect (%) of crude extract of *Ocimum basilicum* and known antioxidant BHT, at 1.0 mg/mL

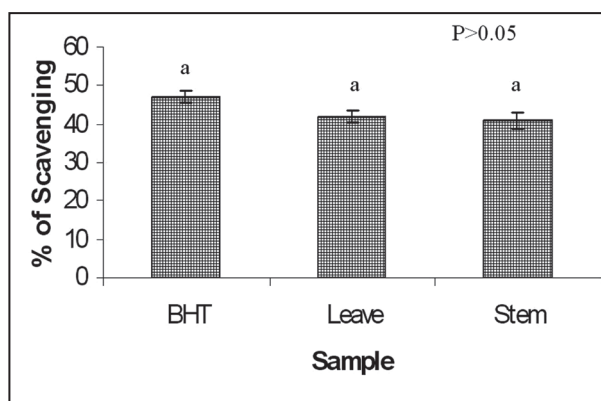


Figure 4. Scavenging effect (%) of crude extract of *Coleus blumei* and known antioxidant BHT, at 1.0 mg/mL

The IC_{50} value of the extracts ranged from 0.181 mg/mL - 2.85 mg/mL (Table 1). When the IC_{50} value was referred to the species and different parts, the highest content was found in the stem of *Orthosiphon stamineus* (2.85 mg/mL) and the lowest one in the leaf of *Ocimum basilicum* (0.193 mg/mL).

In conclusion, the screening of antioxidant activity performed on selected plants from Penang, Malaysia which traditionally used as food and herbs shows that they are endowed with potentially exploitable antioxidant activities. Finally, future investigations will concern in-depth analyses (both in terms of chemistry and antioxidant activity) of their main components and the *in vivo* appraisal of their pharmacology.

Table 1. IC₅₀ values of the crude extract of Lamiaceae plants

Extract Concentration mg/mL	% of Scavenging								
	BHT	<i>Mentha arvensis</i> Leave	<i>Mentha arvensis</i> stem	<i>Orthosiphon stamineus</i> Leave	<i>Orthosiphon stamineus</i> Stem	<i>Ocimum basilicum</i> Leave	<i>Ocimum basilicum</i> Stem	<i>Coleus blumei</i> Leave	<i>Coleus blumei</i> stem
0.05	45.1	14.58	16.47	8.65	10.13	20.08	20.11	5.35	0.97
0.1	46.91	43.11	42.97	41.53	41.59	45.35	44.64	41.8	40.74
0.2	49.24	51.47	50.63	50.22	49.87	55.94	52.24	47.35	48.26
0.3	57.57	55.66	66.37	63.95	64.27	60.75	60.12	50.12	53.82
*IC ₅₀	0.181	0.224	0.195	0.209	2.85	0.193	0.203	0.261	0.242

* The IC₅₀ was obtained by linear regression equations.

REFERENCES

- [1] Lachance PA, Nakat Z, Jeong WS. 2001. Antioxidants: an integrative approach. *Nutrition*. 17: 835–838.
- [2] Bravo L. 1998. Polyphenols: chemistry, dietary sources, metabolism, and nutritional significance. *Nutrition Reviews*. 56: 317-333.
- [3] Oktay M, Gulcin I, Kufrevioglu OI. 2003. Determination of in vitro antioxidant activity of fennel (*Foeniculum vulgare*) seed extract. *Lebensmittel-Wissenschaft und Technologie*. 36: 263-271.
- [4] Ames BN, Shigenaga MK, Hagen TM, 1993. Oxidants, antioxidants, and the degenerative diseases of aging. *Proceedings of the National Academy of Science of U.S.A.* 90: 7915–7922.
- [5] Aruoma OI. 1998. Free radicals, oxidative stress, and antioxidants in human health and disease. *J Am Oil Chem Soc.* 75: 199–212.
- [6] Amakura Y, Umino Y, Tsuji S, Ito H, Hatano T, Yoshida T, and Y. Tonogai. 2002. Constituents and their antioxidative effects in eucalyptus leaf extract used as a natural food additive. *Food Chemistry*. 77: 47–56.
- [7] Da Silva JMR, Darmon N, Fernandez Y, Mitjavila S. 1991. Oxygen free radical scavenger capacity in aqueous models of different procyanidins from grape seeds. *Journal of Agriculture and Food Chemistry*. 39: 1549–52.
- [8] Iriti M, Faoro F. 2004. Plant defense and human nutrition: phenylpropanoids on the menu. *Current Topics in Nutrition Research*. 2: 47– 65.
- [9] Paiva NL. 2000. An introduction to the biosynthesis of chemicals used in plant–microbe communication. *Journal of Plant Growth Regulation*. 19: 131–143.
- [10] Chalker-Scott L. 1999. Environmental significance of anthocyanins in plants stress responses. *Photochemistry and Photobiology*. 70: 1–9.
- [11] Winkel-Shirley B. 2002. Biosynthesis of flavonoids and effects of stress. *Current Opinion in Plant Biology*. 5: 218–223.