



REGULAR ARTICLE

PHYTOCHEMICAL CONSTITUENT AND ANTIOXIDANT ACTIVITY OF EXTRACT FROM THE LEAVES OF *OCIMUM BASILICUM*

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SUMMARY

Ocimum basilicum leaf extracts were investigated for phytochemical constituent and antioxidant activity. Tests for tannins, steroids, terpenoids, flavonoids and cardiac glycosides were positive in both ethanolic and aqueous extracts. The ethanolic extract of *O. basilicum* had a DPPH scavenging activity of 85.2% at 250 µg/ml and a reductive potential of 0.79 at 100 µg/ml. These values were comparable with those of gallic acid, 91.1% at 250 µg/ml and ascorbic acid, 0.76 at 60 µg/ml as standards for DPPH scavenging activity and reductive potential, respectively. These findings suggest that the rich phytochemical content of *O. basilicum* and its good antioxidant activity may be responsible for its popular and wide traditional use.

Keywords: *Ocimum basilicum*, phytochemicals, antioxidant activity, reductive potential.

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1. Introduction

The genus *Ocimum* comprises more than 150 species and is considered as one of the largest genera of the Lamiaceae family (Evans WC, 1996). *Ocimum basilicum* L. (sweet basil) is an annual herb which grows in several regions all over the world. The plant is widely used in food and oral care products. The essential oil of the plant is also used as perfumery (Bauer K et al., 1997). The leaves and flowering tops of sweet basil are used as carminative, galactagogue, stomachic and antispasmodic medicinal plant in folk medicine (Chiej R, 1998 and Duke JA, 1989). Antiviral and antimicrobial activities of this plant have also

been reported (Chiang LC et al., 2005 and Baratta MT et al., 1998). There are many cultivars of basil which vary in their leaf color (green or purple), flower color (white, red, purple) and aroma (Morales MR et al., 1996).

Ocimum spp. contain a wide range of essential oils rich in phenolic compounds and a wide array of other natural products including polyphenols such as flavonoids and anthocyanins (Phippen WB et al., 1998). The chemical composition of basil oil has been the subject of considerable studies. There is extensive diversity in the constituents of the

basil oils and several chemotypes have been established from various phytochemical investigations. However, methyl chavicol, linalool, methyl cinnamate, methyleugenol, eugenol and geraniol are reported as major components of the oils of different chemotypes of *O. basilicum* (Grayer RJ et al., 1996, Marotti M et al., 1996 and Chalchat JC et al., 1999).

Plants show enormous versatility in synthesizing complex materials which have no immediate obvious growth or metabolic functions. These complex materials are referred to as secondary metabolites. Plants secondary metabolites have recently been referred to as phytochemicals. Phytochemicals are naturally occurring and biologically active plant compounds that have potential disease-inhibiting capabilities. It is believed that phytochemicals may be effective in combating or preventing disease due to their antioxidant effect (Halliwell and Gutteridge, 1992; Farombi et al., 1998). Antioxidants protect other molecules (*in vivo*) from oxidation when they are exposed to free radicals and reactive oxygen species which have been implicated in the aetiology of many diseases and in food deterioration and spoilage (Halliwell and Gutteridge, 1992; Kasaikina, 1997; Farombi, 2000; Koleva et al., 2000).

Medicinal plants have been used for centuries before the advent of orthodox medicine. Leaves, flowers, stems, roots, seeds, fruit, and bark can all be constituents of herbal medicines. The medicinal values of these plants lie in their component phytochemicals, which produce definite physiological actions on the human body. The most important of these phytochemicals are alkaloids, tannins, flavonoids and phenolic compounds (Hill, 1952). *Ocimum basilicum* Linn (Labiatae) is grown for the essential oils in its leaves and stems. Eugenol, thymol, citral, geraniol and linalool have been extracted from the oil (Sulistiarini, 1999). Essential oils from the plant have been reported to possess an interesting spectrum of antifungal properties (Dubey et al., 2000).

The antinociceptive property of the essential oil of the plant has been reported (Rabelo et al., 2003). The whole plant and the essential oil are used in traditional medicine especially in Africa and India. The essential oil is also an important insect repellent. *O. basilicum* is germicidal (Nakamura et al., 1999; Pessoa et al., 2003; Holets et al., 2003) and has found wide use in toothpastes and mouth washes as well as some topical ointments. It is used as an excellent gargle for sore throats and tonsillitis. It is also used as an expectorant and a cough suppressant. The plant extract is used against gastrointestinal helminths of animals and man (Fakae, 2000; Chitwood, 2003). In addition, *O. basilicum* carminative properties make it a good choice for upset stomach. It is used as an emetic and for hemorrhoids. The plant is also used for the treatment of rheumatism, paralysis, epilepsy, high fever, diarrhea, sunstroke, influenza, gonorrhoea and mental illness (Dhawan et al., 1977; Oliver, 1980; Abdulrahman, 1992; Osifo, 1992; Sofowora, 1993; Sulistiarini, 1999).

The present work has been designed to evaluate the antioxidant potential of extracts from the leaves of *O. basilicum* and to explore the basis for its traditional use.

2. Materials and Methods

Plant materials

Leaves of *O. basilicum* were collected from Botanical garden of A. A. Govt. Arts College Namakkal, India. They were air dried, packed in paper bags and stored. The dried leaves were pulverized and 200 g of the pulverized sample was extracted with 500 ml of 80% ethanol by maceration for 72 h. The ethanolic extract was concentrated in a rotary evaporator and thereafter preserved for further use. An aqueous extract was also prepared from the pulverized sample for the purpose of comparison of the phytochemical constituents with that of the ethanolic extract.

Phytochemical screening

Chemical tests were carried out on the aqueous and ethanolic extracts for the

qualitative determination of phytochemical constituents as described by Harborne (1973), Trease and Evans (1989) and Sofowora (1993).

Total phenolic content

Total phenolic content was determined using Folin-Ciocalteu reagent as previously described (McDonald et al., 2001). Total phenol value was obtained from the regression equation: $y = 0.0055x + 0.1139$ and expressed as mg/g gallic acid equivalent using the formula, $C = cV/M$; where C = total content of phenolic compounds in mg/g GAE, c = the concentration of gallic acid (mg/ml) established from the calibration curve, V = volume of extract and m = the weight of pure plant ethanolic extract (g).

DPPH radical scavenging activity

The ability of the extract to scavenge DPPH radical was determined according to the method described by Mensor et al. (2001). Sample stock solutions (1.0 mg/ml) were diluted to final concentrations of 250, 125, 50, 25, 10 and 5 µg/ml in ethanol. 1 ml of a 0.3 mM DPPH ethanol solution was added to 2.5 ml solution of the extract or standard and allowed to react at room temperature for 30 min. The absorbance of the resulting mixture was measured at 518 nm and converted to percentage antioxidant activity (AA%) using the formula:

$$AA\% = 100 - [(Abs\ sample - Abs\ blank) \times 100] / Abs\ control$$

Ethanol (1.0 ml) plus extract solution (2.5 ml) was used as a blank. 1 ml of 0.3 mM DPPH plus ethanol (2.5 ml) was used as a negative control. Solution of gallic acid served as positive control.

Reductive potential

This was determined according to the method of Oyaizu (1986). Different concentrations of the ethanolic extract of *O. basilicum* (20, 40, 60 and 100 µg/ml) in 1 ml of distilled water was mixed with phosphate buffer (2.5 ml, 0.2 M, pH 6.6) and potassium ferricyanide (2.5 ml, 1%). The mixture was incubated at 50°C for 20 min. Trichloroacetic

acid (10%, 2.5 ml) was added to the mixture. A portion of the resulting mixture was mixed with FeCl₃ (0.1%, 0.5 ml) and the absorbance was measured at 700 nm in a spectrophotometer. Higher absorbance of the reaction mixture indicates higher reductive potential.

Statistical analysis

Data were expressed as mean ± □ SEM. A one-way analysis of variance was used to analyze data. P<0.5 represented significant difference between means (Duncan's multiple range test).

3. Results and Discussion

Table 1 shows the phytochemicals detected in *O. basilicum* leaf extract. Tests for tannins, steroids, terpenoids, flavonoids and cardiac glycosides were positive in both ethanolic and aqueous extracts. Anthraquinones were detected only in the aqueous extract while alkaloids were detected only in the ethanolic extract. Saponins were not detected in both extracts. These phytochemicals may be responsible for the medicinal value of *O. basilicum*.

Table 1. Phytochemicals in ethanolic and aqueous leaf extract of *O. basilicum*.

Phytochemicals	Ethanolic extracts	Aqueous extracts
Alkaloids	+	-
Saponins	-	+
Tannins	+	+
Phlobatannins	+	+
Anthraquinones	-	+
Steroids	+	+
Terpenoids	+	+
Flavonoids	+	+
Cardiac glycosides	+	+

+ = Present

- = Absent

The total phenolic content in the ethanolic extract was 5.72 ± 0.04 mg/g GAE. Phenolics are the largest group of phytochemicals and have been touted as accounting for most of the antioxidant activity of plants or plant products. The result of the DPPH scavenging activity of *O. basilicum* extract compared to that of gallic acid (GA) is shown in Figure 1. Both showed a dose-dependent antioxidant activity. The AA% of GA was remarkably higher than that of *O. basilicum* at lower concentrations but significant differences between them seem to be less conspicuous at higher concentrations.

The reductive potentials of *O. basilicum* extract and ascorbic acid (AA) were also dose-dependent (Figure 2). The reductive potential of AA was clearly higher than that of *O. basilicum* at all concentrations except the least (20 μ g/ml). However, it should be noted that the reductive potential of *O. basilicum* was still appreciable. Results from the present investigation shows that *O. basilicum* is rich in phytochemicals.

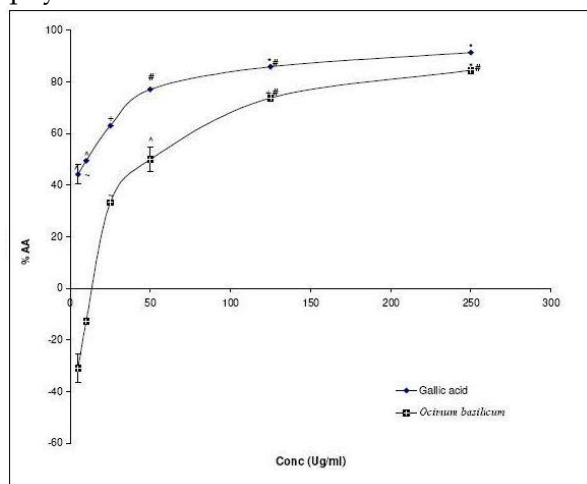


Figure 1. Dose-dependent DPPH scavenging activity of *O. basilicum* leaf extract and gallic acid. Values sharing a common symbol are not significantly different ($P > 0.05$). Significantly different at $P < 0.05$: GA250 vs GA50; GA50 vs GA25; GA25 vs GA10; GA25 vs OG50. Significantly different at $P < 0.01$: GA250 vs OG125; GA10 vs OG25; OG50 vs OG25. Other values significantly different at $P < 0.001$.

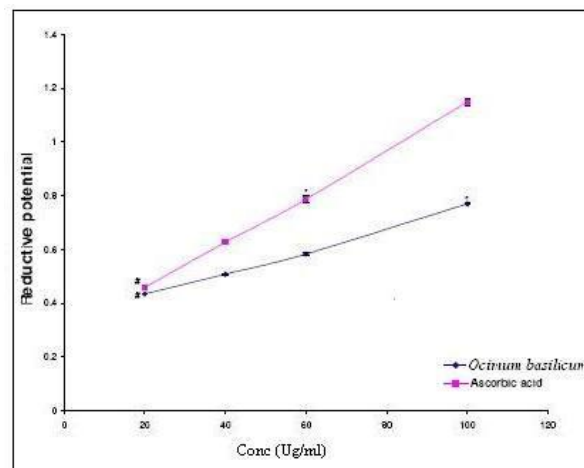


Figure 2. Dose-dependent reductive potential of *O. gratissimum* leaf extract and ascorbic acid. Values sharing a common symbol are not significantly different. OG60 significantly different from AA40 ($P < 0.05$); OG40 significantly different from AA20 ($P < 0.01$). All other values are significantly different ($P < 0.001$).

Specific biologically important compounds have been identified in extracts from the plant by previous workers (Sulistiarini, 1999; Dubey et al., 2000; Holets et al., 2003). The present work also reveals that the extract from the leaves of *O. basilicum* possesses good antioxidant potential presumably because of its phytochemical constituents (Thabrew et al., 1998; Halliwell and Gutteridge, 1992).

The DPPH scavenging activities of OG showed a good correlation with its reductive potentials. These facts justify the medicinal use of the plant for the treatment of various maladies (Dhawan et al., 1977; Oliver, 1980). However, further work is necessary to ascertain the clinical safety of extracts from the plant (Effraim et al., 2001) and to determine appropriate concentration for therapy so as to safeguard the health of the teeming mass of traditional users who more often than not, do not take these factors into consideration.

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