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Study of pharmacological effect of *Ocimum basilicum*: A review

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ABSTRACT

Ocimum basilicum, Ocimum basilicum, also called great basil or Saint-Joseph's-wort, is of family Lamiaceae (mints) .Basil is possibly native to India. The aim of this study was to overview its therapeutic effects than its nutritive and industrial effects. This review article was carried out by searching studies in PubMed, Medline, Web of Science, and Iran Medex databases .The initial search strategy identified about 98 references. In this study, 37 studies was accepted for further screening and met all our inclusion criteria [in English, full text, therapeutic effects of Ocimum basilicum, and dated mainly from the year 1998 to 2016.The search terms were "Ocimum basilicum,", "therapeutic properties", "pharmacological effects". It is commonly used for anti-osteoporotic effect .anxiolytic and sedative effect, Anti-colitis effect, antibacterial activity, cytotoxic activity, cardiovascular disease, anti-hepatotoxicity effect, antioxidant capacity, Phytoremediatory effect, hypoglycemic effect, antihypertensive effects, vasorelaxant and anti-platelet effect, anti-inflammatory effect, Anti-thrombotic effect, synergistic effects, insecticidal fumigant.

Keywords: *Ocimum basilicum*, Phytochemicals, Therapeutic effects, Pharmacognosy, Alternative and complementary medicine.

INTRODUCTION

Ocimum basilicum, also called great basil or Saint-Joseph's-wort [1], is of family Lamiaceae [2] (mints) .Basil is possibly native to India [3]. Depending on the species and cultivar, the leaves may taste somewhat like anise, with a strong, pungent, often sweet smell. Basil is most commonly used fresh in cooked recipes. In general, it is added at the last moment, as cooking quickly destroys the flavor [3]. The fresh herb can be kept for a short time in plastic bags in the refrigerator, or for a longer period in the freezer, after being blanched quickly in boiling water [4]. The dried herb also loses most of its flavor, and what little flavor remains tastes very different, with a weak coumarin flavor, like hay [5, 6].When soaked in water, the seeds of several basil varieties become gelatinous.

Chemical components

The various basils have such different scents because the herb has a number of different essential oils[7]that come together in different proportions for various breeds[8, 9]. The strong clove scent of sweet basil is derived from eugenol, the same chemical as actual cloves [10]. The citrus scent of lemon basil and lime basil reflects their higher portion of citral, which causes this effect in several plants including lemon mint [11], and of limonene, which gives actual lemon peel its scent. African blue basil has a strong camphor smell because it contains camphor and camphene in higher proportions. Licorice basil contains anethole[12, 13], the same chemical that makes anise smell

like licorice, and in fact is sometimes called "anise basil. "Other chemicals that help to produce the distinctive scents of many basils, depending on their proportion in each specific breed [14-16].

Anti-osteoporotic effect
The effect of aqueous extract of parsley, basil and chicory on glucocorticoid-induced osteoporosis in rats was examined. Aqueous extracts of parsley, basil and chicory showed bone protection against glucocorticoid-induced in rats. From our results, we concluded that chicory has a potent protective effect more than parsley and basil due to containing flavonoids and inulin [17].

Anxiolytic and sedative effect
The anxiolytic and sedative activity of hydroalcoholic extract and essential oil of O. basilicum in mice was investigated. It shows the anxiolytic and sedative effect of hydroalcoholic extract and essential oil of O. basilicum. The anti-anxiety and sedative effect of essential oil was higher than the hydroalcoholic extract with the same doses. These effects could be due to the phenol components of O. basilicum [8].

Anti-Colitis effect
The ameliorative effect of Ocimum basilicum essential oil on an acetic acid-induced colitis model in rats was examined. The increased level of myeloperoxidase was significantly decreased after the treatment with the essential oil (200 and 400 μL/kg). The results suggest that Ocimum basilicum exhibits protective effect against acetic acid-induced colitis [15].

Antibacterial activity
The pharmacological effects produced on the bacterial strains Staphylococcus aureus and Pseudomonas aeruginosa was determined when standard antibiotics and O. basilicum essential oil are combined. Ocimum basilicum essential oil associated with existing standard antibiotics may increase their antibacterial activity, resulting in a synergistic activity against bacterial strains of clinical importance. The antibacterial activity of O. basilicum essential oil may be associated with linalool [18].

The effect of the treatment of chitosan at various concentrations upon sweet basil before seeding and transplanting was investigated in aspects of the amount of phenolic and terpenic compounds, antioxidant activity, and growth of the basil, as well as the phenylalanine ammonia lyase (PAL) activity. It demonstrates that an elicitor such as chitosan can effectively induce phytochemicals in plants, which might be another alternative and effective means instead of genetic modification [19].

The antimicrobial activities of chloroform, acetone and two different concentrations of methanol extracts of Ocimum basilicum L. were studied. The cells of microorganisms, which were treated and untreated with plant extracts, were observed by using the scanning electron microscope. It was observed that the treated cells were damaged [20].

Cytotoxic activity
The anticancer activity and antioxidative potentials of methanolic extracts of Mentha longifolia L. (ML) and Ocimum basilicum L. (OB) that grown in Madina province, western region, Saudi Arabia was investigated. It concluded that, OB and ML extracts have the potency to act as powerful antioxidants and protect against DNA damage and have cytotoxic activity against MCF-7 cell line [21].

Cardiovascular disease
Antihypertensive and antithrombotic effect of this plant on prostaglandins was examined. OBL and its extracts increased 6-keto-PGF1α and reduced PGE2 and TXB2 production in a dose and time-related manner. This could indicate simultaneous inhibition of COX-2 and stimulation of endothelial COX-1. The butanol fraction seemed most promising in this respect [22].

Anti-Hepatotoxicity effect
The protective role of methanolic leaf extract of Ocimum basilicum L. against benzene-induced hematotoxicity in Swiss albino mice was assessed. it indicates that the secondary metabolites of O. basilicum L. methanolic leaf extract, comprising essential oil monoterpene geraniol and its oxidized form citral as major constituents, have modulatory effect in cell cycle deregulation and hematological abnormalities induced by benzene in mice[23].

Six triterpene acids identified as betulinic, oleanolic, ursolic, 3-epimaslinic, alphitolic and euscaphic acids have been isolated from a dichloromethane extract of hairy root cultures of Ocimum basilicum L. (Lamiaceae). All tested compounds displayed hepatoprotective activity comparable to oleanolic and ursolic acids [24].

Antioxidant capacity
The antioxidant properties of five different extracts of Ocimum basilicum L. and Origanum vulgare L. were studied. Their antioxidant activity varied that it could be partially explained by the levels of phenolics and flavonoids in the investigated O. basilicum and O. vulgare extracts [25].

In a study, it was explored that how nutrient availability, specifically nitrogen fertilization, affects the production of polyphenolic compounds in three cultivars of the culinary herb, basil (Ocimum basilicum L.).Basil cultivar was also determined to have a statistically significant effect on total phenolic levels, rosmarinic and caffeic acid concentrations, and antioxidant activities [26].

The effect of methyl jasmonate (MeJA) in terms of its induction of inherent bioactive chemicals in sweet basil (Ocimum basilicum L.) was evaluated after MeJA was sprayed on healthy basil plants. The total phenolic content of the sweet basil significantly increased after 0.1 and 0.5 mM MeJA treatments compared with the control not subjected to MeJA. [27].

The antioxidant activity of a methanolic extract of Ocimum basilicum L. (sweet basil) was examined using different in vitro assay model systems. The results showed that one rosmarinic acid can capture 1.52 radicals, and furthermore, the existence of a synergistic effect between alpha-tocopherol and rosmarinic acid was revealed [28].

Phytoremediatory effect
Two plant species of the genus Ocimum were studied regarding their Phytoremediatory effect: Ocimum basilicum L. and Ocimum minimum L. and it demonstrated that both species can endure endosulfan pollution (as high as 1 g kg (-1)) in soils. O. basilicum seems to be an adequate candidate for bioremediation of soils polluted with endosulfan [29].

Hypoglycemic effect
The in vitro hypoglycemic activity of basil (Ocimum basilicum) aqueous extract was investigated. It concluded that basil aqueous extract via antioxidant and possibly α-glucosidase and α-amylase inhibiting activities, offered positive benefits to control diabetes [30].

Antihypertensive effects
The possible antihypertensive effects of OBL extract in renovascular hypertensive rats was examined. The effects of OBL on blood pressure, cardiac hypertrophy and ET, are consistent with an effect on ET-converting enzyme, and warrant further exploration [31].

Vasorelaxant and anti-platelet effect
the endothelium-dependantvasorelaxant and anti-platelet aggregation activities of an aqueous extract from Ocimum basilicum were studied. The results show that the HCD statistically decreases vascular relaxation in HCG compared to NCG ($p<0.001$) and increases the vascular responses to phenylephrine ($p<0.02$). The use of Ocimum basilicum as medicinal plant could be beneficial for cardiovascular system [32].

Anti-Oxidative stress
The protective effect of essential oils and water-soluble extracts derived from three different cultivars of sweet basil has been evaluated in cultured cardiomyocytes. The results indicate that (a) in vitro antioxidant activity is not predictive of biological activity and (b) basil can yield extracts with substantially different protective effects, in relation to composition and extraction techniques. Variation among different cultivars has also been detected [33].

Anti-inflammatory effect
The effects of Ocimum basilicum L. tincture in acute inflammation induced with turpentine oil in Wistar male rats was evaluated. Ocimum basilicum tincture significantly reduced the total leukocyte count, monocyte percentage, activation of circulating phagocytes, but had a slight inhibitory effect on NO synthesis. Compared to diclofenac, Ocimum basilicum tincture had a smaller inhibitory effect on all tested parameters.The tested Ocimum basilicum

tincture has important anti-inflammatory effects on bone marrow acute phase response and a reduced one on NO synthesis[34].

Anti-thrombotic effect

The effects of aqueous extract of Ocimum basilicum L (OBL) on platelet aggregation and experimental thrombus was studied.OBL possesses an inhibitory effect on platelet aggregation induced by ADP and thrombin that is dose-dependent and results in an anti-thrombotic effect in vivo which develops progressively over 7 days and disappears over 3-7 days. The active ingredient now needs to be characterized [35].

Synergistic effects

Essential oils extracted by hydrodistillation from five different varieties of Ocimum basilicum L. plants were examined for antimicrobial activity against a wide range of foodborne Gram-positive and -negative bacteria, yeasts and moulds by an agar well diffusion method. The results of the current study indicate the need for further investigations to understand the antimicrobial effects of basil oils in the presence of other food ingredients and preservation parameters [36].

Insecticidal fumigant

Essential oils from sweet basil, Ocimum basilicum, and African basil, O. gratissimum, (Labiatae) grown in Guinea were obtained by steam distillation. It was concluded that aromatized powders have no significant effect on the seed germination rate. After 5d, a rate of 88% germination was seen in seeds treated with aromatized powder and protected from insects, compared with 97% for untreated seeds that were not exposed to insects [37].

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