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PHYTOCHEMICAL AND PHARMACOLOGICAL STUDIES ON *OCIMUM BASILICUM* LINN - A REVIEW

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ABSTRACT

Plants are one of the most important sources of medicines. Basil (*Ocimum basilicum* Linn.) is one such plant which symbolizes all that is wondrous in nature because, the whole plant has been used as traditional medicine for household remedy against various human ailments from antiquity. The objective of this paper is to review the literature regarding *Ocimum basilicum*, specifically for its chemical properties, therapeutic benefits and scientific studies. This review consists of all publications relevant to *Ocimum basilicum* that were identified by the authors through a systemic search of major computerized medical database. Studies indicate *Ocimum basilicum* to possess analgesic, anti-inflammatory, antimicrobial, antioxidant, anti-ulcerogenic, cardiac stimulant, chemomodulatory, CNS depressant, hepatoprotective, hypoglycemic, hypolipidemic, immunomodulator and larvicidal activities. The drug was also searched for its folkloric claims. It is used in traditional medicine as a tonic and vermifuge, and Basil tea taken hot is good for treating nausea, flatulence, and dysentery. The oil of the plant has been found to be beneficial for the alleviation of mental fatigue, cold, spasm, rhinitis, and as a first aid treatment for wasp stings and snakebites.

Preliminary studies have found various constituents of *Ocimum basilicum* to exhibit a variety of therapeutic effects. These results are very encouraging and indicate that this drug should be studied more extensively to confirm these results and to find other potential therapeutic effects.

Keywords: Basil; Pharmacological studies; Phytochemical studies; Ethnobotanical reports.

INTRODUCTION

The medicinal plants are rich in secondary metabolites and essential oils of therapeutic importance. The important advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability. Because of these advantages the medicinal plants have been widely used by the traditional medical practitioners in their day to day practice. Among the plants known for medicinal value, the plants of genus *Ocimum* are rich in phenolic compounds

and are very useful for their therapeutic potentials.¹ *Ocimum basilicum* Linn. popularly known as "Sweet basil" is used in both Unani and Ayurvedic system of medicine². Moreover, among more than 150 species of the genus *Ocimum*, Basil is the major essential oil crop which is cultivated commercially in many countries³ It is a popular herb, valued for its rich and spicy, mildly peppery flavour with a trace of mint and clove and has been used widely as a food ingredient for flavouring confectionary,

baked foods and meat products.⁴ It is used both as a culinary and an ornamental herb.⁽⁵⁾

Historical Background

The history of use of Basil as a medicine can be traced back to the age of Dioscorides as he mentioned it in one of the earliest book on medicinal plants, *De Materia medica*, as a potent antidote for scorpion sting. Several interesting believes are ascribed to the historical use of Basil. Europeans considered it to be funereal and to dream of it, unlucky whereas, in Italy, women wear it in hair and the youths stick a spring of it above the ear when they go courting.⁽⁶⁾ In India, Hindus believed that a leaf of Basil buried with them would serve as their passport to the heaven. In early 1600, the English used it in their food and in doorways to ward off uninvited pests, such as flies as well as evil spirits.

Taxonomic Classification⁸

Kingdom	: Plantae
Subkingdom	: Tracheobionta
Superdivision	: Spermatophyta
Division	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Asteridae
Order	: Lamiales
Family	: Lamiaceae
Genus	: <i>Ocimum</i>
Species	: <i>basilicum</i>
Binomial Name	: <i>Ocimum basilicum</i> ⁹

Etymology of Basil

The name basil is thought to be derived from the Greek word “Basileus”, meaning “Royal or King”. It is often referred as King of the Herbs.⁷

Synonyms¹⁰

- O. caryophyllatum* Roxb.
- O. minimum*
- O. pilosum*

Varieties¹¹

Ocimum basilicum* var. *purpurscens is popularly known as Purple Basil. The leaves are as same as that of sweet basil. It is known for its

culinary properties and excellent ornamental foliage.

Ocimum basilicum* var. *genovese is also called Genovese Basil This basil has dark green leaves that grows upto 2 inches long. It is used on a large scale in pesto and garlic dishes.

Ocimum basilicum* var. *crispum is used largely as garnishing in salad or in sauce, it does not taste much as compared to other green basil and popularly known as Lettuce Leaf Basil. Its leaves are quite wide and large.

Description of Plant

Vernaculars

Ocimum basilicum is known by different names in different languages around the world including the Indian sub continent. In English, it is known as Basil, Common Basil or Sweet Basil¹² whereas, in Hindi¹³ and Bengali⁶, it is called *Babui Tulsi*. The plant is known as *Badrooj*, *Hebak* or *Rihan* in Arabic; as *Nasabo* or *Sabje* in Gujrati and as *Jangli Tulsi* in Urdu. *Tohrakhurasani* and *Okimon* are the ascribed names of the plant in Persian and Unani languages⁹

Habitat and Distribution

Sweet basil is indigenous to Persia and Sindh and lower hills of Punjab in India.⁽¹³⁾ The plant is widely grown as an ornamental and field crop throughout the greater part of India, Burma, Cylone⁹ and several Mediterranean countries including Turkey.

Botanical description of the plant

An erect branching herb, 0.6 to 0.9 m high, glabrous, more or less hispidly pubescent. Stems and branches are green or sometimes purplish. Leaves of *Ocimum basilicum* are simple, opposite,⁽¹²⁾ 2.5-5 cm or more long, ovate, acute, entire or more or less toothed or lobed with a cuneate and entire base. The petiole is 1.3-2.5 cm long. The leaves have numerous dot like oil glands which secrete strongly scented volatile oil. Whorls densely racemose, where the terminal receme is usually much longer than the lateral

ones. The bracts are stalked, shorter than the calyx, ovate and acute. Calyx is five mm long, enlarging in fruit and very shortly pedicelled. Its lower lip with the two central teeth is longer than the rounded upper lip. Corolla being 8-13 mm long are white, pink or purplish in colour, glabrous or variously pubescent. The upper filaments of slightly exerted stamen are toothed at the base. Nutlets are about two mm long, ellipsoid, black and pitted.⁹ Sepals of flower are five and remain fused into a 2-lipped calyx. Ovary is superior and there is a 2-carpellary, 4-locular and a 4-partite fruit of four achenes.¹²

Ethnobotanical Description

Basil is well-known as a plant of folk medicinal value and as such is accepted officially in a number of countries. The leaves of the Basil are used in folk medicine as a tonic and vermifuge, and Basil tea taken hot is good for treating nausea, flatulence, and dysentery. The oil of the plant has been found to be beneficial for the alleviation of mental fatigue, cold, spasm, rhinitis, and as a first aid treatment for wasp stings and snakebites.¹⁴

Pharmacological Actions

The plant is stomachic, alexipharmic and antipyretic. It also possesses diuretic and emmenagogue properties. In Annam, an infusion of the plant is considered to be antihelminthic, diaphoretic, anti emetic and anti diarrhoeaic.⁹ Diuretic, aphrodisiac and anti dysenteric actions have also been ascribed to the seeds of this plant. The juice of the plant shows carminative, stimulant^{12,13} and anti bacterial actions; its essential oil possesses anti bacterial, anti fungal and insecticidal effects¹⁰. The flowers of this plant are stimulant, diuretic and demulcent in action.¹⁵ The flowers are also considered to be carminative, anti-spasmodic and digestive stimulant.¹²

Therapeutic Uses

Plant: Basil is useful in diseases of heart and blood, biliousness *kapha* and *Vata*, leucoderma

etc. The juice relieves joints pain, gives luster to eyes, is good for toothache, earache and cures epistaxis when used with camphor.⁹ The juice of plant is dropped into ears to cure dullness of hearing.^{10,13} The infusion of the plant is given to treat cephalgia and gouty joints and used as gargle for foul breath. Basil cures headache, aids digestion⁹ and acts as a mild laxative. The plant is also reported to keep away the flies and snakes.¹⁶ A 12% decoction of the plant used as irrigation in nasal myosis, produces anesthesia and acts as a parasiticide and antiseptic, so that the larvae which causes the disease rendered inactive and expelled. The plant is useful in treatment of stomach complaints, fever, cough and gout.¹³ It cures Kustha (obstinate skin disease including leprosy) and scorpion bite. According to Ainslie, it is used in India to assuage the pain of childbirth.¹⁷

The warm leaves juice of this plant along with honey is used to treat croup.¹⁵ It also forms an excellent nostrum for the cure of ringworm. It is used as a lotion for sore eyes too. In Guinea, the decoction of leaves and stem are given to treat fever, neuralgia, catarrh, renal troubles and burning micturation.⁹ In Ethiopia, leaves are used against malaria, headache and diarrhea. In homeopathy, the fresh mature leaves are used to treat spermatorrhoea, blood dysentery, haematuria, inflammation and congestion of kidney. Aqueous extract of the leaves is used in southern Nigeria to relieve the severe pain associated with post natal uterine contraction. The juice of leaves is used as insecticide and applied on the nostrils of camels to kill the worms, which infest them during winter^{13,16} The juice of the leaves is also used to treat otitis. The roots of this plant are used to treat bowel complaints of children.^{9,12,15}

The seeds washed and pounded are used in poultices for unhealthy sores and sinuses. An infusion of seeds is given in fever. The seeds are chewed in case of snake-bite, one portion is swallowed and the other portion is applied to the

bitten part.⁹ A cold infusion of it is said to relieve the after pain of parturition. They are also given internally to treat cystitis, nephritis and in internal piles.¹³ Due to the mucilaginous and cooling effect, an infusion of basil seed is given to treat gonorrhoea, diarrhoea and chronic dysentery.¹⁶

Scientific studies

Physicochemical Study

Bihari *et al.*,¹⁸ carried out the physicochemical evaluation of *Ocimum basilicum*. The total ash value of the plant is found to be 8.7% whereas,

the acid insoluble, water soluble and the sulphated ash values are recorded as 0.3%, 3.7% and 0.6 % respectively. Extractive values of Basil are reported as 6.24%, 4.0% and 3.7% (w/w) in water, alcohol and ether, respectively. As much as 0.1% foreign organic matter is also contained in *O. basilicum*. The following table shows the Fluorescence characteristics of the test drug with different reagents as observed under day light and UV light.

Table 1: Fluorescence characteristics of *O.basilicum* with different chemical reagent

Sl. No.	Material	Day light	UV 254 nm	UV 366nm
1	Powder as such	LG	GY	GY
2	P + HCL (IN)	P	DB	DB
3	P + 50% KOH	DYBR	DB	DB
4	P + 50% H ₂ SO ₄	YG	DB	DB
5	P + 50% HNO ₃	GP	DB	DB
6	P + conc. HNO ₃	R	DB	DB
7	P + conc. H ₂ SO ₄	BB	DB	DB
8	P + Iodine in water	GP	DB	DB
9	P + In NaOH (IN) in methnol	YBR	DB	DB
10	P + Acetic acid	BR	DB	DB

(BB-Brownish black; BR-Brown; DB-Dark black; DYBR-Dark yellow brown; GP-Greenish pink; GY-Greenish yellow; LG-Light green; P-Pink; R-Red; YBR-Yellowish brown; YG-Yellowish green)

Phytochemical Studies

Fresh flowering herb yield essential oil containing small amount of estragol, eucalyptol, ocimene, linalool acetate, eugenol, 1-epibicyclosiquiphellandrene, menthol, menthone, cyclohexanol, cyclohexanone, myrcenol and nerol.¹⁹ The leaves distilled with water yield about 1.56% of yellowish green oil, lighter than water which when kept in air, solidifies almost wholly, as crystallized from alcohol forms 4-sided prism, having a faint smell and taste. Crystallized from water, it forms white, transparent, nearly tasteless tetrahedrons.⁶ The green leaves contain high concentration of vitamins minerals and oils.^{10,16} Bihari *et al.*,¹⁸ reports that the phytochemical screening of *O.basilicum* revealed the presence of glycoside, gums, mucilage, proteins, amino acids, tannins, phenolic compound, triterpenoids steroids, sterols, saponins, flavones and flavonoids in it. A

total of 29 compounds representing 98.0±99.7% of the oils are identified by Hussain *et al.*,³ in the plant of *Ocimum basilicum*. Linalool is the main constituent of essential oil (56.7-60.6%). Analyzed essential oils mainly consists oxygenated monoterpenes (60.7-68.9%) followed by sesquiterpenes hydrocarbons (16.0-24.3%) and oxygenated sesquiterpenes (12.0-14.4%). The major oxygenated monoterpenes are: linalool, camphor, cis-geraniol and 1,8-cineole. While, a-bergamotene, b-caryophyllene, germacrene D, c-cadinene and bicyclogermacrene are the main sesquiterpene hydrocarbons whereas, epi-a-cadinol and viridiflorol are the important oxygenated sesquiterpene.

Seasonal variations in chemical composition of drug

The herb, depending upon the stage of its life and the place of its cultivation, contains varying amount of essential oil. The chemical

composition of Basil as affected by the four seasons namely, summer, autumn, winter and spring was investigated by Hussain *et al.*,³. He found that the content of the essential oils is distributed unevenly among seasons. The highest amount of the oil in the *O. basilicum* is found during winter (0.8%) which decreases significantly ($p < 0.05$) in summer to 0.5%. Samples collected in winter are found to be richer in oxygenated monoterpenes (68.9%), while those of summer are higher in sesquiterpene hydrocarbons (24.3%). The contents of most of the chemical constituents vary significantly ($p < 0.05$) with different seasons.

Horticulture Characteristics

Javanmardi *et al.*,⁵ studied the horticulture characteristics, including quantitative and qualitative traits along with the chemical variation of phenolic acids of 23 accessions of Basil from Iran and reported that rosmarinic acid, lithospermic acid B, vanillic acid, *p*-coumaric acid, hydroxybenzoic acid, syringic acid, ferulic acid, protocatechuic acid, caffeic acid, and gentisic acid are found in various concentrations in flower and leaf tissues of different accessions of Basil. Rosmarinic acid is the predominant phenolic compound found in several basil accessions. Morphological studies of accessions show a high level of variability in recorded traits. Quantification of phenolic acids using high performance liquid chromatography shows drastic variations between accessions. Rosmarinic acid, chicoric acid and caftaric acid (in the order of most abundant to least; all derivatives of caffeic acid) were identified by Lee and Scagel²⁰ in fresh basil leaves. Moreover, Fresh Basil leaves contain higher concentrations of chicoric acid than dried basil flakes.²⁰ The seeds (from Pakistan) contain 21.4% fixed oil with the following fatty acid composition: lauric 0.85; myristic 0.36; palmitic 9.70; stearic 5.45; oleic 13.33; linoleic 321.81 and linolenic 48.50%.¹⁶

Drying Methods

In a study carried out by Polatc and Tarhan,²¹ Basil (*Ocimum basilicum*) was dehydrated using five different drying methods (contact drying, oven drying, shaded-open atmosphere drying, sun drying and microwave drying). The drying performance (drying time, final moisture content), drying kinetics, color analysis, essential oil analysis, were performed for all drying methods. Research results show that the drying Basil with air heated up to 45-55 °C is appropriate.

Extractive Methods

Soran²² used three different techniques (maceration, sonication and extraction in microwave field) for extraction of essential oils from *Ocimum basilicum*. The extracts were analyzed by TLC/HPTLC technique and the fingerprint information was obtained. The gas chromatograph with flame- ionization detection was used to characterize the extraction efficiency and to identify the terpenic bioactive compounds. They concluded that most efficient extraction technique is maceration followed by microwave and ultrasound. The best extraction solvent system is ethyl ether + ethanol (1:1, v/v).

Aroma Profile

Aroma profiles of five Basil samples were analyzed by Klimankova *et al.*,²³ A headspace solid-phase microextraction method coupled to gas chromatography–ion trap mass spectrometry has been developed and applied for profiling of volatile compounds released from five *Ocimum basilicum* cultivars grown under both organic and conventional conditions. Comprehensive two-dimensional gas chromatography coupled to time-of-flight mass spectrometry was employed for confirmation of identity of volatiles extracted from the basil headspace by solid-phase microextraction. Linalool, methyl chavicol, eugenol, bergamotene, and methyl cinnamate were the dominant volatile components, the relative content of which was found to enable differentiating between the cultivars examined.

The relative content of some sesquiterpenes, hydrocarbons benzenoid compounds, and monoterpene hydrocarbons was lower in dried and frozen leaves as compared to fresh basil leaves. A sensory analysis of the all examined samples proved the differences between evaluated cultivars.

Pharmacological studies

Analgesic Activity

Methanolic extract of *Ocimum basilicum* was evaluated for its analgesic activity by tail immersion method in Swiss mice. The extract was able to show analgesic activity at 200 mg/kg concentration which was well comparable with the standard drug, aspirin.²⁴

Anti inflammatory activity

Benedec *et al.*,²⁵ investigated the effects of *Ocimum basilicum* tincture (1:10) in acute inflammation induced with turpentine oil (IM 0.6 ml/100 gm) in Wistar male rats. Compared to diclofenac, the tincture had a smaller inhibitory effect on all tested parameters. Thus, *Ocimum basilicum* tincture has important anti inflammatory effects on bone marrow acute phase response and a reduced one on NO synthesis. Chinnasamy *et al.*,²⁶ too observed somehow, similar results when they investigated the anti inflammatory activity of crude methanolic extract of *Ocimum basilicum* where, it showed a good inhibitory effect on the proliferative response of peripheral blood mononuclear cells in mitogenic lymphocyte proliferation assays in healthy individuals. Furthermore, gene expression studies on lipopolysaccharide induced production of proinflammatory cytokines like Tumor necrosis factor- α , Interlukin-1 β and IL-2 showed down regulation of the markers. It also suppressed the induction of inducible nitric oxide synthase and the subsequent production of nitric oxide in a time-dependent manner. The results showed that *Ocimum basilicum* crude methanolic extract inhibits the key proinflammatory cytokines and

mediators, which accounts for its anti inflammatory effects.

Antimicrobial Activity

When investigated for *in vitro* anti microbial properties, none of the ethanol, methanol and hexane extract from *Ocimum basilicum* showed antifungal activities but anti candidal and anti bacterial effects. Both the hexane and methanol extracts, but not the ethanol extracts, inhibited three isolates out of 23 strains of *Candida albicans*. The hexane extract showed a strong and broader spectrum of antibacterial activity followed by methanol and ethanol extracts. The minimal inhibition zones of the hexane, methanol and ethanol extracts ranged from 125 to 250 μ l/ml, respectively.²⁷ Somewhere in other part of the world, Harsh *et al.*,²⁸ investigated the Rosmarinic acid (RA), a multifunctional caffeic acid ester present in sweet basil (*Ocimum basilicum*) and found that RA shows antimicrobial activity against a range of soil-borne microorganisms, with its most deleterious effects against *Pseudomonas aeruginosa*. Confocal and scanning imaging of *Aspergillus niger* hyphae treated with RA (250 μ M) exhibited damaged cytoskeletons with broken interseptas and convoluted cell surfaces resulting in a multinucleated stage compared to the untreated control. Both strains of *P. aeruginosa* tested, PAO1 and PA14, showed increased spatial division and condensation of DNA upon RA treatment compared to the untreated control. Their findings suggest that in nature RA is a constitutive antimicrobial compound that may be released into the surrounding rhizosphere upon microbe challenge.

Anti oxidant activity

In vitro antioxidant activities of 50% hydroalcoholic extract of *Ocimum* species namely *Ocimum basilicum* and *Ocimum sanctum* were achieved at varying concentrations (10-50 μ g/ml) using DPPH radical scavenging activity. The results showed that *Ocimum basilicum* had more antioxidant activity than

Ocimum sanctum.¹ In another study carried out by Meera *et al.*,²⁹ the ethanolic extract of *Ocimum basilicum* exhibited potent antioxidant effects. A similar result was obtained by Hussain *et al.*,³ while investigating the essential oil from the aerial parts of Basil which exhibited good antioxidant activity as measured by 2,2'-diphenyl-1-picrylhydrazyl DPPH free radical-scavenging ability, bleaching β -carotene in linoleic acid oxidation. Seung *et al.*,³⁰ examined twelve aroma constituents of basil for its antioxidant activity using the aldehyde/carboxylic acid assay. Eugenol, thymol, carvacrol, and 4-allylphenol showed stronger antioxidant activities than did the other components tested in the assay. They all inhibited the oxidation of hexanal by almost 100% for a period of 30 days at a concentration of 5 μ g/ml. Their antioxidant activities were comparable to those of the known antioxidants, α -tocopherol and butylated hydroxy toluene.

Anti-ulcerogenic activity

Ocimum basilicum (aerial parts) powder and its aqueous and methanolic extract decrease the ulcer index in aspirin induced gastric ulcer in rat model. Moreover, the acid output was decreased by its methanolic extract while hexosamine secretion was enhanced. This suggests that its ulcerogenic effect is due to the decreased acid and pepsin outputs which enhance gastric mucosal strength.³¹ The fixed oil of *Ocimum basilicum* has also been found by Singh *et al.*,³² to possess significant antiulcer activity against aspirin, indomethacin, alcohol, histamine, reserpine, serotonin and stress-induced ulceration in experimental animal models. Significant inhibition was also observed in aspirin-induced gastric ulceration and secretion in pylorus ligated rats. Hence, concluded that the lipooxygenase inhibiting histamine antagonistic and anti secretory effects of the oil could probably contribute towards its antiulcer activity.

Cardiac stimulant activity

The alcoholic and aqueous extract of *Ocimum basilicum* exhibited a cardiac tonic and β -adrenergic effect respectively, when screened by Muralidharan and Dhananjayan,² for their effects on frog-heart in *situ* preparation. The alcoholic extract produced significant positive inotropic and negative chronotropic actions on frog heart. A significant decrease in membrane Na⁺/K⁺ ATPase, Mg²⁺ ATPase and an increase in Ca²⁺ ATPase pointed the basis for its cardiotoxic effect. The aqueous extract produced positive chronotropic and positive inotropic effects which were antagonized by propranolol.

Chemomodulatory activity

The effects of doses of 200 and 400 mg/kg of hydroalcoholic extract of the fresh leaves of *Ocimum basilicum* on xenobiotic metabolizing Phase I and Phase II enzymes, antioxidant enzymes, glutathione content, lactate dehydrogenase and lipid peroxidation in the liver of 8-9 weeks old Swiss mice were examined. Furthermore, the anticarcinogenic potential of basil leaf extract was studied, using the model of Benzo(a)pyrene-induced forestomach and 7,12 dimethyl benz(a)anthracene-initiated skin papillomagenesis. Basil leaf extract was very effective in elevating antioxidant enzyme response. There were significant decrease in lipid peroxidation and lactate dehydrogenase activity. Chemopreventive response was evident from the reduced tumour burden, as well as from the reduced percentage of tumor-bearing animals. Basil leaf augmented mainly the Phase I enzyme activity. Moreover, Basil leaf extract was highly effective in inhibiting carcinogen induced tumor incidence in both the tumor models at peri-initiation level.³³

CNS Activities

Ismail¹⁴ screened the essential oil of *Ocimum basilicum* (OB) for some CNS activities viz. sedative, hypnotic, anticonvulsant, local anesthetic etc. on mice. Higher doses of OB essential oil produced motor impairment at all

time intervals. Pentobarbitone sleeping time was significantly increased by all doses of the essential oil higher than 0.2mLkg^{-1} . Intraperitoneal administration of OB essential oil significantly increased the latency of convulsion and percent of animals exhibiting clonic seizures in a dose-dependent manner. The ED₅₀ values of the essential oil of OB were 0.61mLkg^{-1} , 0.43mLkg^{-1} , and 1.27mLkg^{-1} , against convulsions induced by pentylenetetrazole, picrotoxin, and strychnine, respectively. A study of the local anesthetic activity of the OB essential oil by using a nerve block model employing in frog revealed that it had no local anesthetic effect.

Hepatoprotective Activity

Significant hepatoprotective effects were obtained by ethanolic extract of leaves of *Ocimum basilicum* against liver damage induced by H₂O₂ (hydrogen peroxide) and CCl₄ (Carbon tetrachloride) as evidenced by decreased levels of antioxidant enzymes in a trial carried out by Meera *et al.*,²⁹ The extract also showed significant anti lipid peroxidation effect *in vitro*.

Hypoglycaemic Activity

The hypoglycaemic effect of the aqueous extract of *Ocimum basilicum* was investigated in normal and streptozotocin diabetic rats by Zeggwagh *et al.*,³⁴ to conclude that the aqueous extract exhibits potent anti hyperglycaemic activity in diabetic rats without affecting basal plasma insulin concentrations.

Hypolipidaemic activity

Armani *et al.*,³⁵ in their study evaluates the lipid lowering effect of aqueous *Ocimum basilicum* extract in Triton WR-1339-induced hyperlipidaemic rats. At 24 h following *Ocimum basilicum* administration, total cholesterol, triglycerides and LDL-cholesterol levels decreased by 56%, 63% and 68%, respectively, in comparison with the Triton treated group and HDL-cholesterol was not increased significantly. The hypolipidaemic effect exerted was markedly stronger than the effect induced by fenofibrate treatments. Further, it was demonstrated that

Ocimum basilicum aqueous extract displayed a very high antioxidant power.

Immunomodulatory activity

The aqueous and ethanolic extract of leaves of *Ocimum basilicum* (OB) was administered orally at the dose of 400mg/kg/day in mice, showed a significant increase in the production of circulating antibody titre in response to sheep red blood cells. A significant increase in both primary and secondary haemagglutination antibody (HA) titre was observed while compared to control group, whereas, in cyclophosphamide treated group OB showed significant increase in HA titre. OB significantly potentiated the delayed type hypersensitivity reaction by facilitating the footpad thickness response to sheep red blood cells in synthesized mice. Also OB evoked a significant increase in percentage neutrophil adhesion to Nylon fibres and phagocytic activity. The study demonstrates that OB triggers both specific and non specific responses to a greater extent. From the results obtained and phytochemical studies, the immunostimulant effect of OB could be attributed to the flavonoid content.⁷

Larvicidal activity

Laboratory investigation carried out by Arthi *et al.*,³⁶ using the extract of plants like *Ocimum basilicum* and microbial pesticide spinosad against the malarial vector *Anopheles stephensi* Liston showed 85% mortality.

DISCUSSION

The idea of using medicinal plants to treat human ailments is not new and in many developing countries their use is still vogue. *Ocimum basilicum* Linn. is a very important drug and is traditionally used to treat a number of health problems. This review provides evidence based scientific validation to some of its action and therapeutic uses described in ethnobotanical literature. But the compounds responsible for these activities have not yet been clearly

elaborated so, further studies should be taken into consideration to justify its reported actions through related phytoconstituents.

CONCLUSION

In the recent years, traditional system of medicines have emerged as a potential source to cope with the growing rate of chronic, degenerative, environmental, lifestyle and stress related diseases. Traditionally, Basil has been used as whole herb to treat a good number of diseases. The wide range of and the diversities in the action of Basil can be a result of synergistic effect of its phytochemical constituents which cannot be fully duplicated with the isolated extracts or constituents. This article briefly reviews the traditional knowledge, ethnomedicinal, pharmacological and therapeutic applications of the plant *Ocimum basilicum* Linn. This is an attempt to compile and document information on different aspects of the plant and highlight the need for research and development.

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