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Phytochemical screening & antimicrobial activity of *Ocimum gratissimum* review

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Abstract
Most of these natural products are secondary plant metabolites. Keeping this in view, it is an urge to synthesize some natural products and test their bioactivity and also planned for the isolation of some bioactive natural compounds. The plant *Ocimum gratissimum* which is a naturally available species throughout the India. The plan of work is to isolate different types of phytochemicals from the leaves of *Ocimum* gratissimum by using different types of solvents by extraction process and the selected phytochemical compounds obtained from the plant by extraction are tested for whether the compounds shows antimicrobial activity against the selected species of microorganisms was carried out.

Keywords: *Ocimum gratissimum*, protein oxidation, lipid peroxidation, anxiolytic activity

Introduction
Organic chemistry is an art executed science. The art of synthesis and isolation of natural products and bioactive compounds makes it one of the most interesting and finest areas of modern chemistry.

The key role played by plant-based systems in the healthcare of different cultures has been extensively documented, and the World Health Organization (WHO) has estimated that approximately 65-80% of the world's population relies mainly on plant-derived traditional medicines for their primary health care.

Most of these natural products are secondary plant metabolites. Keeping this in view, we felt an urge to synthesize some natural products and test their bioactivity and also planned for the isolation of some bioactive natural compounds.

Natural products have played a key role in health care and prevention of diseases for the past thousands of years. Several ancient civilizations, such as Indians, Chinese, and North Africans have provided written evidence for the use of natural sources for curing various ailments.

The importance of natural products as anticancer agents can be seen between the years 1981-2006, where about a hundred anticancer agents have been developed, of which, nine were pure natural products, eleven were derived from a natural product pharmacophore, eighteen were natural product mimics, and twenty five were natural product derivatives.

Thus making the natural sources as significant contributors to the health care system.

Ocimum gratissimum locally called as Nimma tulasi is widespread in India and South Africa and also grows across tropical regions of the globe. It is a traditional herb with a wide array of phytochemical constituents and has been reported for its diverse physiological properties. Earlier reports showed that *O. gratissimum* possess a wide range of phytochemicals such as flavonoids, polyphenols and volatile compounds like eugenol, thymol, and geraniol Its medicinal uses include vasorelaxation, anti-inflammatory, anti mycotoxigenic and antioxidant activities.

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 [1].

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. 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. 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 *Ocimum gratissimum* 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. Essential oils from the plant have been reported to possess an interesting spectrum of antifungal properties. The antinociceptive property of the essential oil of the plant has been reported. 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 [2].

O. gratissimum is germicidal 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. In addition, *O. gratissimum* 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, diarrhoea, sunstroke, influenza, gonorrhoea and mental illness. In addition, the plant is used as a spice and condiment in the southern part of Nigeria.

Ocimum gratissimum is herbaceous plant belonging to Lamiaceae family. The plant is indigenous to tropical areas especially India and West Africa. It is known by different names in various parts of the world. In India, the most commonly used ones being Vriddhu tulasi (Sanskrit), Ram tulasi (Hindi), Nimma tulasi (Kannada). *Ocimum gratissimum* has been used extensively in the traditional system of medicine in several countries. It is used for medicinal, condiment and culinary purpose. The flowers and the leaves of this plant are rich in essential oils so it is used in preparation of tea and infusion. The plant is commonly used in folk medicine to treat different diseases such as upper respiratory tract infections, diarrhoea, headache, eye and skin diseases, pneumonia, cough, fever and conjunctivitis.

In India, the whole plant has been used for the treatment of sunstroke, headache and influenza as a diaphoretic, antipyretic and for its anti-inflammatory activity. The infusion of Ocimum gratissimum leaves is used as pulmonary antisepticum, antitussivum and antispasmodicum. Since no work has so far been cited on Ocimum gratissimum root, the present study deals with the investigation of medicinally useful bioactive phytoconstituent in root extracts and their antimicrobial activity along with total phenolic content [3].

Taxonomy

- Kingdom: *Plantae*
- Division: *Magnoliophyta*
- Order: *Lamiales*
- Family: *Lamiaceae*
- Genus: *Ocimum*
- Species: *gratissimum*
- Binomial name: *Ocimum gratissimum L*

Distribution

Ocimum gratissimum plant native to Africa Madagascar, Southern Asia, and the Bismarck Archipelago and naturalised in Polynesia, Hawaii, Mexico, Panama, West Indies, Brazil, and Bolivia

Some of the species are found in Nigeria and also in Tropical and Sub tropical regions.

Morphology

- Ocimum gratissimum is a shrub up to 1.9m in height with stems that are branched.
- The leaves measure up to 10 x 5 cm, and are ovate to ovate-lanceolate, sub-acuminate to acuminate at apex, cuneate and decurrent at base with a coarsely crenate, serrate margin, pubescent and dotted on both the sides.
- The leaves show the presence of covering and glandular trichomes. Stomata are rare or absent on the upper surface while they are present on the lower surface.
- Ordinary trichomes are few, while the long ones up to 6-celled are present on the margins mostly; the short ones which are 2 celled, are mostly found on the lamina.

Botanical description

Ocimum gratissimum is an aromatic, perennial herb, 1-3 m tall; stem erect, round-quadrangular, much branched, glabrous or pubescent, woody at the base, often with epidermis peeling in strips. Leaves opposite; petiole 2-4.5 cm long, slender, pubescent; blade elliptical to ovate, 1.5-16 cm x 1-8.5 cm, membranaceous, sometimes glandular punctuate, base cuneate, entire, margin elsewhere coarsely crenate-serrate, apex acute, puberulent or pubescent. Inflorescence a verticillaster, arranged in a terminal, simple or branched raceme 5-30 cm long; rachis lax, softly pubescent; bracts sessile, ovate, 3- 12 mm x 1-7 mm, acuminate, caducous; pedicel 1-4 mm long, spreading or ascending, slightly curved. Flowers in 6-10-flowered verticillasters, small, hermaphrodite; calyx 2-lipped, 2-3 mm long, in fruit 5-6 mm, pubescent, upper lip rounded and recurved, reflexed in fruit, lower lip with 4, narrow, pointed teeth, central pair of teeth minute and much shorter than the upper lip; corolla campanulate, 3.5-5 mm long, 2-lipped, greenish white, pubescent outside, upper lip truncate, 4-fid, lower lip longer, declinate, flat, entire; stamens 4, declinate, in 2 pairs, inserted on the corolla tube, filaments distinctly exserted, upper pair with a bearded tooth at the base; ovary superior, consisting of 2 carpels, each 2-celled, style 2- fid.

Fruit consisting of 4, dry, 1-seeded nutlets enclosed in the persistent calyx (the lower lip closing the mouth of the fruiting calyx); nut let subglobose, 1.5 mm long, rugose, brown; outer pericarp not becoming mucilaginous in water [4].

Chemical constituents

The compounds obtained from the plant are Thymol, eugenol, methyl chavical, Gratissimol, Alkaloids, tannins, flavonoids,

Oligosaccharides, thymol, P-cymene, ϒ terpene, trans sabiene hydrate, Euginol, 1,8 cineole, linalool, methyl chavicol and methyl eugenol.
The compounds obtained from the seeds of the plant are Pentoses, hexoses, uronic acid, lipids, thymol and eugenol.
The compounds obtained from the leaves of the plant are Eugenol, methyl eugenol, cis-ocimene, pinene, camphor, germacrene-D, trans-carypophyllene, farnesene, 1-bisabolene, Eugenol, bisaboline, thymol, citral, ethyl cinnamate, linalool, ϒ terpinene, p-cymene, limonene, terpinolene, 1,8-cineole and oleanolic acid.
The compounds obtained from the aerial parts are Eugenol, linalool, limonene, methyl eugenol, β-caryophyllene, farenesene, α-terpineol, β-salinene, methyl isoeugeneol, α-copaene, bisabolol, α-pinene, p-cymene, fenchone, cubenene, camphene, T-cadinol, ϒ-eudesmol, sabinene, myrcene, β-bisoboline, α-humelene and β-elemene.
The compounds obtained by aqueous extract are Tannins, steroids, triterpinoids and carbohydrates [5].

Pharmacological activities

- Antimicrobial and Antifungal activity
- Anticonvulsant activity
- Antidiabetic activity
- Antidiarrheal activity
- Anti inflammatory activity
- Antihypertensive activity
- Antimutagenic activity
- Antioxidant activity
- Analgesic activity
- Reduces hair loss
- Leishmanicidal activity
- Ovicidal activity
- Wound healing
- Immunostimulatory effect &
- Cardiovascular activity

Rishikumar Shukla *et al.*, (2015): In present study, phytochemical screening, total phenolic content, and antimicrobial activity were carried out. Extraction was performed successively with petroleum ether, diethyl ether, acetone and distilled water. Phytochemical screening indicates the presence of various phytoconstituents. Petroleum ether and diethyl ether extracts are rich in triterpenoids while acetone extract has carbohydrate, inulin, flavonoids and phenolic compounds. Diethyl ether extract has highest concentration of total phenol (48.823%) which is responsible for its excellent antioxidant activity. Antimicrobial activity was performed against four bacterial and two fungal strains by agar well diffusion method which showed that diethyl ether extract is more prominent against all strain. These results revealed that diethyl ether extract could be used as an antimicrobial agent of natural origin in pharmaceutical industry [6].

Ladipo, M.K *et al.* (2010): Antibacterial properties of Ocimum gratissimum was determined and tested against pure cultures of clinical isolates of Escherichia coli, Klebsiella, Shigella and Salmonella species. Water and Ethanol were used for the extraction of the active constituent of the plants. Water extract of Ocimum gratissimum was not as effective as the ethanolic extracts against the tested organisms. The phyto chemcial analysis carried out on the plant revealed the presence of alkaloids, tannins, saponin, steroids, cardiacglycoside, flavonoid, terpenoids and phenol. The results of this study suggest the possibility of using the ethanolic extract in treating the diseases caused by the test organisms [7].

Amadi, J.E *et al.* (2010): A study was carried out to evaluate the antifungal properties of African Basil (*Ocimum gratissimum* L.) extracts on Aspergillus repens, Curvularia lunata and Fusarium moniliforme using the pour plate method. A phytochemical screening of the extracts was also carried out to determine the constituents of O. gratissimum. Water, ethanol and acetone were the extractants used. Results showed that radial growth in all the three test organisms was impaired by the addition of the extracts in the culture medium used. The test organisms differed in their reaction to the different extracts but on the whole, growth inhibition increased with the concentration of each extract. Phytochemical screening of the different extracts showed that *O. gratissimum* contains important compounds such as carbohydrates, reducing sugars, lipids, flavonoids, alkaloids, steroids, tannins and saponins. The significance of these results is discussed [8].

G.I. Ameh *et al.* (2010): Methonolic extract of the leaves of *Ocimum gratissimum* L. was investigated for its phytochemical composition and antimicrobial properties. Phytochemical screening of the leaf extract revealed the presence of carbohydrates, proteins and terpenoids in high concentrations (+++). Reducing sugars, glycosides and tannins occurred in moderate amounts (++) while saponins, flavonoids and steroids were present in low concentrations (+). The leaf extract was devoid of alkaloids, resins, oils and acidic compounds (-). Bacillus subtilis was the only microorganism sensitive to the leaf extract and had an inhibition zone diameter of 12.5mm. The minimum inhibitory concentration (MIC) of the extract against B. subtilis was 100 mg/ml. The antibacterial potential of this plant part which can be exploited in the future for its bioactive constituents has thus been demonstrated [9].

Abdullahi Mann *et al.* (2012): *Ocimum gratissimum* Linn (Lamiaceae) is an herbaceous plant reputed for many medicinal and agronomic practices amongst Nigerian peasant farmers. *O. gratissimum* was investigated for antimicrobial activity against ten micro-organisms and for grain protectant activity Sagainst Callosobrochus maculatus. The phytocontituents of the aerial part of *O. gratissimum* were extracted with 95% ethanol using the percolation method. The crude ethanol extracted was further fractionated into hexane, chloroform and methanol fractions. The fractions obtained were screened for phytoconstiteunts, antimicrobial and grain protectant properties. Result showed that hexane fraction exhibited the highest antimicrobial activity against Vibrio cholera and Klebsiella pneumonia. Similarly hexane fraction also showed the highest grain protectant activity. The other extracts of the *O. gratissimum* did not significantly inhibit both bacterial growth and grain infestation. However, the methanol fraction contains phytocompounds such as phenolic compounds associated with antioxidant properties. The study shows that *O. gratissimum* extractants are potential sources of antimicrobial and preservative agents [10].

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