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A COMPREHENSIVE VIEW ON THE *OCIMUM* BASSED ANTI BACTERIAL ESSENTIAL OIL

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ABSTRACT

Antimicrobial agents are essential drugs for human health and animal health and welfare. The antimicrobial agents covers most of the area among the all types of the drug class in spite of that the resistance to antimicrobials is a global public health concern that is impacted by both human and non human usage. The active ingredients and their semi synthetic derivatives have been recognized as the primary pharmacophore for the bioactivity especially antibacterial activity. The antibacterial drug resistance continues to be a public health concern, where the new drug discovery for the resist bacteria is a concern, where the various approaches been tried, but in the current scenario the approach is inclined toward the natural product and their derivatives. The review will summarized with the essential oil extracted from the *Ocimum* Genus, and their use as an antibiotic activity. The biological activities of the privileged plant have been summarized in a few review articles, so need of the systemic review is in public domain, in view of these, the aim of this review is to provide a platform to know the importance of *Ocimum* Genus. Here in the focus was on those literature reports wherein the uses of the *Ocimum* 6Genus and their antibiotics activity have been described. The importance of the plant and the active constituent's has been summarized herein with the suitable literature references.

KEYWORDS: *Ocimum* Genus, anti-biotics Plant, Natural source, Tulsi, Drug discovery, Ayurveda, Eugenol.

INTRODUCTION

The importances of the medical plants have been recognized by the civilization, many years ago for the variety of purposes like food preservation, pharmaceutical, alternative medicine,

and natural therapies.[1] The acceptance of the naturally derived drug or other substance is due to their certain advantageous and considered the more capability to biodegrade than the synthetic compounds, which makes them patient as well as the environment acceptable.[2] The naturally derived plant and the extracts mostly poses the antioxidants, antibacterial, cytotoxic, antiviral, fungicidal activity, moreover it also gained momentum as a nutrients in recent years. The positive feedback from the consumer was enough to boost up the market for the naturally derived products. In the recent years, multiple drug resistance in both human and plant pathogenic microorganisms have been developed due to the irregular use of commercial antimicrobial drugs for the treatment of infectious diseases from the bacteria.[3] In pursuit of the new drug candidate, with the additional activity for the resistant bacteria is a challenging task, which need to take care in the future to find new therapeutic agents, plants that have antimicrobial activity have attracted attention with the broad range of the activity with the beneficial effect on the patients accepted.[4]

The Ocimum sanctum (OS) is well known in the ancient Indian history is known as **T**ulsi, a spiritually described plant in the various literatures. The plant also possess various medicinal values, which is well documented for its therapeutic potentials, moreover the plant indicated the anti-asthmatic and cough suppressant action, The leaf of **Tulsi**, is very common for the Indian family, which boosted the immunity of the human too.[5] Last several decades has been utilized to know about the active ingredient responsible to the various pharmacological activities. The scientist fraternity, led to the discovery into the next level, where they found the phenol based compound was found to be an active constituent of the plant. The phenolic compound was confirmed as essential oils & eugenol, it can be extracted from the every part of the plants, which can be easily extracted by many reported methods to get the maximum yield of the active constituents.[6] The pharmacological activity of the extracted oil was found diversified on the bases of the therapeutic potential; however the plant was used for the various sicknesses, since the ancient treatment therapy. It is still used for the health benefits of human kind.[7]

The common plant of the Lamiacae family is the *Ocimum sanctum* which is abundant in the region of southern Asia. It exert various therapeutical activities like anti-inflammatory, analgesic, antipyretic, antidiabetic, hepatoprotein, hypolipidemic, immune modulatory and anti-stress activity. It has been observed that the eugenol, linoleic acid, luteolin, β-sitosterol prevents skin, liver, oral and lung cancers. Their effects are mediated by increasing the anti-

oxidant activity, inducing apoptosis, altering the gene expression, and inhibiting metastasis.[8] The antibacterial activities of the privileged plants with the various species have been summarized with the limited data. In view of these, the aim of this review is to provide a platform to know the importance of Ocimum Genus. A keen Attention has been focused on those literature reports wherein the uses of the concern Genus, and antibiotics have been described. The importance of the plant and the active constituent's has been summarized herein with the suitable literature references. The main variety of Tulsi in the Indian sub continental has been chareactersed with the three specific ocimum genum *i.e.* Rama Tulsi (*Ocimum sanctum*) with green leaves and Krishna Tulsi (*Ocimum tenuflorium*) with purple leaves, and Vana Tulsi (*Ocimum gratissimum*), moreover a prominent species of Occimum which does not show dominance in this area but in the other area of world, is known as Ocimum basilicum.known as sweet basil. Tulsi is considered as the holy plant in the Indian rituals. Since ancient times, It is widely used for religious and medicinal purposes.

Ocimum basilicum (Sweet basil)

The Sweet basil (*Ocimum basilicum* L.), is one of the most used and pronounced aromatic plants, among the ocuimum species, which posses the variety of chemical constituents related to the season, it varies according to the seasonal changes with the morphological as well as chemical.[9] Chemical composition, antioxidant and antimicrobial activities of basil (Ocimum basilicum) essential oils depends on seasonal variations, Evaluation of antimicrobial activity of the essential oils and linalool, the most abundant component, against bacterial strains: Staphylococcus aureus, Escherichiacoli, Bacillus subtilis, Pasteurella multocida and pathogenic fungi Aspergillus niger, Mucor mucedo, Fusarium solani, Botryodiplodia theobromae, Rhizopus solani.[10]

The essential oils and methanol extracts of Ocimum basilicum L., Ocimum kilimandscharicum Guerke, Ocimum gratissimum L, Ocimum canum Sims, and Ocimum tenuiflorum L. (green type) were found to be potential for the bacteriacidal activity. The chemical composition of essential oils of Ocimum species was profound with the antibacterial action, which was screened with two Gram-positive (Bacillus subtilis, Micrococcus luteus) and five Gram-negative (Pseudomonas aeruginosa, Shigella dysenteriae, Escherichia coli, Vibrio cholera, and Shigella flexneri) bacteria. The antibacterial results revealed the essential oils of Ocimum basilicum L. Ocimum kilimandscharicum Guerke, and Ocimum gratissimum L. dominatlly inhibits the growth of all of the microorganisms used,

especially of the Gram-negative strains, whereas other two essential oils showed moderate activities. The results were satisfactory to show the antibacterial activity of the essential oil and certainly it could be beneficial to use as natural preservative ingredients in food and/or pharmaceutical industries.[11]

The predominant study of the antibacterial activity of the essential oils from three Ocimum species have been evaluated (Ocimum basilicum L. var. Genovese, O. gratissimum and O. tenuiflorum). The essential oils obtained from the plant through the hydrodistillation have been analyzed chromatogram and found with the Linalool (65.38%, 74.22%, 38.60%), eugenol (5.26%, 3.47%, 10.20%) and tau-cadinol (8.18%, 3.47%, 10.20%) appear as the main components in Ocimum basilicum L. var. Genovese, O. gratissimum and O. tenuiflorum. Almost all the essential oils showed antibacterial activity against Staphylococcus aureus and Escherichia coli with the effective level of concentration. Ocimum basilicum L. var. Genovese oil produced the strongest antibacterial effect on S. aureus and E. coli.[12] One of the prestigious group evaluated total of thirty six chemical constituents, among them linalool (69.87%) was found to be the major constituent. Other main identified constituents included geraniol (9.75%), p-allylanisole (6.02%), 1,8–cineole (4.90%), trans–α–bergamotene (2.36%) and neryl acetate (1.24%), moreover the invitro activity of the essential oil revealed that the essential oil of *O. basilicum* was found to be excellent antibacterial activity against Gram–positive bacteria and moderate activity against Gram–negative bacteria.[13]

The specific chromatographic techniques were used to identify the structure and other properties of essential oils from seven *Ocimum* taxa (*O. americanum* L., *O. basilicum* L., *O. campechianum* Mill., *O.* x *citriodorum*Vis., *O. kilimandscharicum* Baker ex Gürke and three botanical varieties and cultivars of *Ocimum basilicum* L.: 'Genovese', var. *difforme* and var. *purpurascens*). Initial screening of the oil was against common pathogens (*Enterococcus faecalis*, *Enterococus faecium*, *Escherichia coli* 0157:H7, *Listeria monocytogenes*, *Listeria ivanovii*, *Proteus vulgaris*, *Staphylococcus aureus*, *Staphylococcus epidermis*) using the filter paper disc agar diffusion as well as the modified technique. A broad variation in the antibacterial properties of the essential oils was observed. Through E. coli and it was inhibited by O. basilicum 'Genovese' based essential oil with the prominent effect on the bacterial cell, while Ocimum americanum and Ocimum x citriodorum essential oils were the

most effective against Enterococcus faecalis, Enterococcus faecium, P. vulgaris, S. aureus and S. epidermis.[14]

Ocimum sanctum (ShyamaTulsi)

Ocimum sanctum is used as a traditional medicine and possesses various biological activities because of the active components present in the plant such as eugenol, linoleic acid, oleic acid, rosmarinic acid, ocimarin, isorientin, orientin, aesculectin, aesculin, chlorgrnic acid, galuteolin, gallic acid, citronellal, camphene, sabinene, dimethylbenzene, ethylbenzene, vitamin C, and calcium.[15]

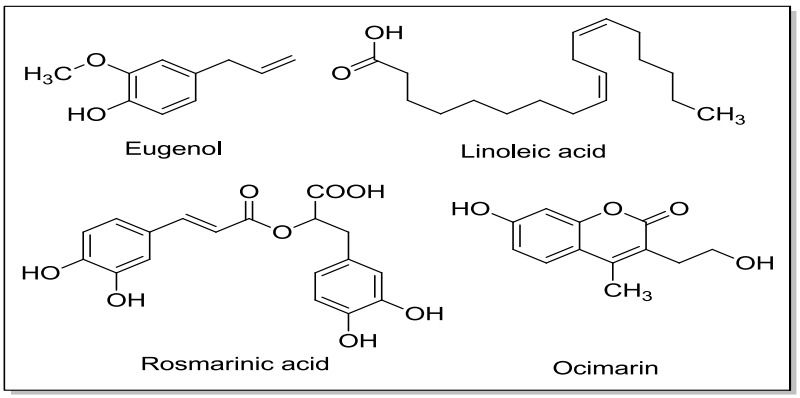

Figure. 1: Structures of active components of *Ocimum sanctum*.

Singh *et al.* exhibited growth inhibitory activity of aqueous and alcoholic extract of OS against *E. coli* and *V. cholera* respectively.[16] Sood *et al.* reported the antimicrobial activity of OS against *B. pumilus*, *P. aeruginosa* and *S. aureus.* They observed that alcoholic extract of OS exhibited activity against multidrug-resistant strains of *S. aureus.*[17]

Ocimum Tenuiflorum (Krishna Tulsi)

The *Ocimum tenuiflorum*, is known as tulsi, tulasi or Holy Basil, a distinct plant of the belongs Lamiaceae family, it is widely speeded all over the world as a cultivated plant.[18] It is a straight, much branched sub-shrub approx 50 cm tall with additional feature like hairs on stem and simple opposite green leaves that are strongly fragmented.[19] The holy plant is distinctly identify by two main morphotypes cultivated in India *i.e.* green-leaved (Sri or Lakshmi tulsi) and purple-leaved (Krishna tulsi)[20] and both of the plant shows antioxidant property[21] and have antimicrobial properties of essential oils distilled from Australian-grown Ocimum tenuiflorum (Tulsi), however, the oils, at concentrations of 4.5 and 2.25% was completely inhibiting the growth of Staphylococcus aureus (including MRSA) and

Escherichia coli, while the same concentrations only partly inhibited the growth of Pseudomonas aeruginosa.[22] In ayurveda, *O. tenuiflorum* has been used for adaptogenic/antistress activity.[23] It has been widely reported to possess antipyretic, antiasthmatic, antioxidant, analgesic, and anti-inflammatory properties.[24] One of the group reported the bioinspired synthesis of silver nanoparticles with the aid of novel, non toxic ecofriendly biological material namely *Ocimum tenuiflorum* leaf extract. It acts as reducing as well as stabilizing agent as well as the synregesitic antimicrobial activity.[25] The active essential oil of the plants are Eugenol, Carvacrol, Linalool, and β caryophyllene, which have been used widey for many years in food products, perfumery, and dental and oral products. The Indian based group revealed the action of leaves of Ocimum tenuiflorum L. which was extracted and screened for antimicrobial activity through the disc diffusion method against certain Gram-positive and Gram-negative bacteria pathogens. The acetone extracts showed a wide range of antibacterial activity against bacteria, while the methanol extract showed less antimicrobial potential.[26], immunostimulant, free radical scavenging, and nonspecific resistance inducing and plasma cortisol was lowering effects of *O. sanctum.*[27]

***Ocimum Gratissimum* (Vana Tulsi)**

Ocimum gratissimum is the herbaceous plant of the Lamiaceae family. The plant is mostly exists in the tropical areas especially in India and West Africa. In Nigeria, it is found in the savannah and coastal areas. It is cultivated in ceylon, south sea islands, and within Nepal, Bengal, Chittagong and Deccan. It is identified by various names in different parts of the world. In India, it is recognized by its vernacular names as Vriddhu tulsi (Sanskrit), Ram tulsi (Hindi), Nimma tulasi (Kannada).[28]

It is supposed to have originated in Central Africa and South East Asia. Phytochemical screening of this plant showed the presence of many active ingredients, such as flavonoids, triterpenes, alkaloids, citral, saponins, eugenol, linaol, methyl cinnamate, camphor, and thymol.[29] Eugenol, important constituent of *O. gratissimum* has been observed to possess antihelminthic, nematicidal, and insecticidal properties.[30] A number of species of the genus Ocimum reported to yield oils of varied nature, commonly known as basilica oils. According to literature survey, the oils produced from *O. gratissimum* found active against several bacteria (including *Staphylococcus aureus*, *Listeria monocytogenes*, *Escherichia coli* etc.) and fungi (including *Trichophyton rubum*, *T. mentagrophytes* etc.).[31] The oils were used in the treatment of many ailments, including upper respiratory tract infections, diarrhea,

headache, fever, eye problems, skin diseases, and pneumonia and act as a potent antidiabetic agent.[32]

Terezinha *et al.* reported antibacterial activity of *O. gratissimum* and investigated the effect of honey as well as those of surfactants on the antibacterial activity of *O. gratissimum* essential oil. The antibacterial activity of dispersions of ocimum oil (2%) in methanol, honey, a macrogol blend, nonionic and ionic emulsifiers were assessed by cup–plate method and it was found that honey enhanced the antibacterial activity of ocimum oil to a greater extent than the macrogol blend. The activity of ocimum oil emulsion in cetrimide (cationic) was lower than obtained for cetrimide solution. Honey's inherent antibacterial activity, surfactant charge interaction and the effect of emulsification were mentioned to the observed differences in antibacterial activity of the ocimum oil formulations. Result showed that honey was a suitable base for ocimum oil particularly in the treatment of infected wounds.[33]

The prior art search for the *ocimum* plant and their other species and the antibacterial activity leads to the conclusion about the beneficial role of the plant and their extract in the discovery, moreover it gives us the hope to combating the emerging resistant approaches which need to take care with the major scientific evidence, which must be taken in to the further clinical developments as a drug candidate, which can reduce the burden of resistant bacteria. It will be cost as well as therapeutically benefit for the society. The review based on the Tulsi, gives a future scope to work in the field of natural product or naturally inspired complex molecule. The present scenario related to the *Ocimum* plant based essential oil and their derivatives opens up an area of the research for the multi resistant bacteria, which is an urgent need in the public domain so far. The future related to the plant and antibacterial activity related direction for the drug discovery scientist as well as the patients. The report is sufficient to provide a attractive area for the research to get the data of the all chemical ingredients of the plant and screened them against the various pathogenic bacteria.

CONCLUSIONS

The review is the collection of the important data of the ***Ocimum*** plant and their anti bacterial activities. The importance of the natural product based drug has generated interest to develop efficient extraction methods of these important classes of compounds to generate new therapeutic leads for the resist bacteria. The antibacterial activities of the one of the privileged plant have been summarized in a informative manner. The review will provide a platform to know the importance of the *Ocimum* Genus, which is widely known as **Tulsi** in

the entire Indian population. The summarized information has been focused to those literature reports wherein the use of **Tulsi** and the bacterial has been described. In the future it will be a great hope for the resistant bacteria treatment in a better way, which will be a great help the society, with the many advantageous. In the conclusion, here in the plant has been described in a systematic way to examine and will be accepted in the world wide for the utilization of the plants in the near future.

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