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THE CRITICAL REVIEW ON *TULSI* (*Ocimum sanctum*) – A HOLY BASIL MEDICINAL PLANT

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ABSTRACT

Tulsi(*Ocimum sanctum)*has a lot of therapeutic properties. *Tulsi* has also been found in studies to help with diabetes by lowering blood glucose levels. *Tulsi* was found to lower overall cholesterol levels significantly in the same research. *Tulsi*'s positive effect on blood glucose levels is attributed to its antioxidant qualities, according to another study. For severe acute respiratory syndrome, Rama *Tulsi* is an excellent treatment. Colds, fevers, bronchitis, and cough are relieved by the juice of its leaves. Ear drops made from *Tulsi* oil are also utilised. *Tulsi* aids in the treatment of malaria. It works well for indigestion, headaches, hysteria, sleeplessness, and cholera.Ayurvedic practitioners believe that *Tulsi* may not only keep the feared Swine flu or H1N1 flu at bay, but also aid in the quick recovery of an affected individual. "The anti-flu property of *Tulsi* has just lately been identified medical specialists throughout the world," they claim. *Tulsi* strengthens the body's general defence system, including its capacity to combat viral infections.

KEYWORDS – *Tulsi*, *Ocimum sanctum*, Malaria

INTRODUCTION

Only 1% of the world's plant species have been researched phytochemically, leaving an endless possibility for discovering new bioactive compounds, especially in medicinal plants. Several studies have been published on the use of traditional plants and their products in the treatment of illnesses. [1] Despite breakthroughs in medical research and molecular diagnostics, it is estimated that 80 percent of the world's population continues to rely on plant-based medications. [2]

Morphine (derived from*Papaver somniferum*), Ephedrine (derived from Ephedra vulgaris), Aswagandha (derived from *Withaniasomnifera*), Atropine (derived from Atropa belladonna), and Reserpine (derived from Atropa belladonna) [3,4] Essential oils, which are therapeutic in nature, are known to be found in plants with medicinal qualities. The importance of having medicinal plants for therapeutic purposes is that they are inexpensive, effective, and readily available, making them valuable tools for medical practitioners to employ in treating their patients.

The medicinal herb *Ocimum sanctum* L. has a wide range of therapeutic qualities. [3,4] O. sanctum L. (syn O. tenuiflorum L., Mint family: Lamiaceae), often known as "Holy

Basil" in English and "*Tulsi*" in Hindi and Sanskrit, is a bushy plant with a distinct smell that grows in semitropical and tropical climates.[5] *Tulsi* is referred regarded as "Mother" in ancient Hindu texts since it is the most powerful plant among the herbs. *Tulsi* is described as a life-protector in the ancient texts of Padmapurana and *Tulsi*Kavacham.By integrating it into religious ceremonies, ancient sages or rishis secured its absorption into daily life. [6]

This plant is cultivated in households, temples, and gardens across India for medicinal and religious purposes. It's also cultivated commercially across huge swaths of cropland to meet the needs of the herbal, cosmetic, and pharmaceutical sectors. *Tulsi*'s therapeutic properties are well-documented, and it's widely utilised in Indian traditional medicine, such as Ayurveda, Unani, and Siddha, as well as Asian folk medicine in India, Nepal, Sri Lanka, and Malaysia.

Indonesia and Burma use it to cure a variety of ailments, either alone or in conjunction with other herbs. [7] *Tulsi* has been used for hundreds of years for its many therapeutic powers, and it is considered the "elixir of life" in Ayurveda, since it increases lifespan. [8]

Morphology

Tulsi has three varieties: one with a purple-colored leaf or dark variation known as Shyama or Krishna *Tulsi*, and another with a green-colored leaf or light variety known as Rama *Tulsi* or Sri *Tulsi*. The most popular of the three varieties of *Tulsi* is Rama *Tulsi*, which is used for devotion on a regular basis. O. gratissimum, often known as Vana*Tulsi* (or woodland *Tulsi*), is a third type. [9,10]

Active Principles of *Tulsi* Plant

Eugenol has been discovered as a key active component and is said to have several advantages. *Tulsi* is also said to include caryophyllene, eugenol methyl ester, terpinene-4-ol, (+)—cadinene, 3-carene, alphahumulene, citral, ()transcaryophyllene, eugenal, and terpinene-4-ol. 6allyl3′,8dimethoxyflavan3,4′diol, 6allyl3′,8dimethoxyphenoxy)3′,8dimethox yflavan4′ol, 5allyl3(4allylmethoxyphenoxymeth yl) -2-(4-hydroxy-3-methoxyphenyl) -7-methoxy-2,3-dih ydrobenzofuran, 1,2bis (4allyl2methoxy phenoxy) (4-hydroxy-3-methoxyphenyl) -3-methoxypropane, 1-methoxypropane (4 - hydroxy - 3 - m ethoxyphenyl) - tris (4-allyl-2-methoxyphenoxy) propane (1,2,3), 1-allyl-4-(5-allyl-2-hydroxy-3-ethoxyphenoxy)-3-(4-allyl-2-methoxyp henoxy)5methoxybenzene, 3(5allyl2hydroxy3m ethoxyphenyl) -1-(4-hydroxy-3-methoxyphenoxy) -pr op -1-ene, -pinene, -1-pinene, -1-pinene, -1-pinene, -1-pinene, -1- -camphor, carvacrol, luteolin, limatrol, methylchavicol, caryophylline, cirsilineol, decyladehyde, cirsimaritin, isothymusin, isothymonin, apigenin, rosmarinic acid, and cervacrol. Palmitric acid, vallinin, galic acid, Vitamin A, Vitamin C, ursolic acid, and carvacrol are among the other phytoconstituents extracted from various sections of the plant. [11]

Application in medicine

Tulsi has been recorded to be of great use in the treatment of headaches, rhinitis, stomach issues, inflammation, heart illnesses, different types of poisoning, and malaria in the ancient Ayurvedic literature, the Charaka Samhita.[12] The aqueous and alcoholic extracts from the leaves have anti-

inflammatory, antipyretic, analgesic, antiasthma tic, antiemetic, antidiabetic, hepatoprotective, hypotensive, hypolipidemic, and anti-stress agents, among other pharmacological properties.

Furthermore, distillation of the leaves provides plant oil, which has antibacterial, antioxidant, and anti-inflammatory effects and is widely utilised in the pharmaceutical sector, mostly in skin cream formulations. [13]

Antimicrobial properties

*Tulsi*Phytoconstitutents extracted from different sections have been shown to have antibacterial action against a variety of bacteria, the most frequent of which being Candida albicans, Staphylococcus aureus, and Escherichia coli.[14]

The chemical components' actions

Streptococcus mutants is reported to be resistant to the antimicrobials ursolic acid, eugenol, and carvacrol. At a concentration of 4%, it has the greatest antibacterial potential. [15] It also improves metabolic processes and boosts immunity. It also helps to reduce stress and has anti-oxidant properties. Eugenol, palmitic acid, galic acid, vallinin, Vitamin A, and Vitamin C are responsible for protecting the teeth by avoiding dental caries, plaque, bad breath, tartar, and other problems. Gums are helped and protected from periodontitis by the astringent qualities. [16]

Various carcinogens, such as tumour necrosis factor, phorbol ester, okadaic acid, hydrogen peroxide, and cigarette smoke, have been shown to activate nuclear factor (NF)B. Ursolic acid, a pentacyclic triterpene acid from O. sanctum, has been shown to suppress the activities of nuclear factor (NF)B activation. Ursolic acid suppresses kinase activation, p65 phosphorylation, p65 nuclear translocation, and NF-B dependent reporter gene expression by inhibiting their degradation and phosphorylation. Finally, ursolic acid suppresses proliferation, promotes apoptosis, and causes the cell cycle to enter the G1G0 phase. [17]

According to the experiments, significant changes in salivary pH were seen immediately and after 30 minutes after chewing the herbal leaves. There was a substantial rise in pH levels between the mint and curry leaf groups immediately after chewing, and between the *Tulsi* and curry leaf groups 30 minutes after their usage; however, there is no evidence in the literature on the impact of herbal leaves on pH. This is due to the fact that chewing herbal leaves induces salivation, which raises salivary bicarbonate concentrations and hence raises salivary pH. [18]

Immunomodulatory properties

In an experiment on albino rats, extract from fresh leaves of O. sanctum on steam distillation revealed a change in the humoral immune response, which could be attributed to mechanisms like antibody production, the liberation of agents that cause hypersensitivity reactions, and their action on target organs. *Tulsi* boosts cellular and humoral immunity by increasing cell-mediated immunological reactivity and gamma aminobutyric acid (GABA) ergic pathways. [19]

Anti-stress and adaptogenic action

Tulsi has an anti-hypoxic action and improves anoxic stress survival time.[20]*Tulsi* has a remarkable capacity to decrease the oxidative stress created in the body, according to a rabbit research.

Antidiabetic properties

In normal, glucose-fed hyperglycaemic, and streptozotocin-induced diabetic rats, oral treatment of *Ocimum sanctum* extract resulted in a significant reduction in blood sugar. A randomised, placebo-controlled, cross over single blind human experiment found a substantial reduction in fasting and postprandial blood glucose levels of 17.6% and 7.3 percent, respectively, in a randomised, placebo-controlled, cross over single blind human trial. The glucose levels in urine followed a similar pattern. OS also possesses aldose reductase activity, which may aid to reduce diabetic complications including cataracts and retinopathy [21].

Antipyretic properties

Fixed oil has antipyretic action due to prostaglandin inhibition, which was tested in rats with pyrexia caused by the typhoid–paratyphoid A/B vaccine. When the oil was applied topically to the rats' lips, the antipyretic action was evoked by a reduction in fever. The antipyretic effect of 3 ml/kg of fixed oil is equivalent to that of aspirin. [22]

Antifungal properties

Aspergillus Niger, Aspergillus fumigatus, Aspergillus flavus, Rhizopus stolonifera, and Penicilliumdigitatum have all been found to be resistant to *Tulsi* extract. *Tulsi* extract is also sensitive to other therapeutically significant filamentous fungus including Fusarium solani, P. funiculosum, Rhizomucortauricus, and Trichoderma reesi. The components in *Tulsi* extracts such as methyl chavicol and linalool are responsible for this action. [23]

Implications for Oral Hygiene

Irrigant for intracanal use

According to certain writers, *Tulsi* has been proven to be beneficial when administered as an intracanalirrigant of primary molars at a concentration of 4%. The active component eugenol, which was stated earlier in the text, is considered to be responsible for its antibacterial action. Due to its nonbiofriendly responses to growing tooth buds, burning sensation to tissues, and accidental allergic reactions, *Tulsi* can be used safely even at a larger dosage than sodium hypochorite. [24]

Toothache

Due to its cyclooxygenase (COX)-2 inhibitory action, the leaves of O. sanctum, which contain a significant quantity of eugenol and methyl eugenol, have an analgesic effect.[25]

Candidiasis

In a research, the antifungal impact of O. sanctum essential oil and its two main components, eugenol and linalool, were examined against two Candida species known to cause oral candidiasis, with the conclusion that linalool is more promising and effective against Candida.[26]

Anticarcinogenic Substance

In an in vitro investigation, several concentrations of *Tulsi* extracts were tested against Streptococcus mutans, and it was shown that *Tulsi* extracts at 4% have the highest Anticarcinogenic capability.[27]

***Ocimum sanctum* has anticancer properties.**

***Tulsi* has been found to have potent anticancer properties.**

The alcoholic extract (AlE) of O. sanctum leaves modulates the detoxification of carcinogens and mutagens, which is carried out by enzymes such as glutathione-S-transferase, cytochrome b5 and cytochrome P450,[28]and aryl hydrocarbon hydroxylase. *Tulsi* has been shown to have anticancer

properties in human fibrosarcoma cells culture, with AlE of the medication causing cytotoxicity at concentrations of 50 mg/ml and higher. Microscopically, the cells in these experiments had reduced cytoplasm and condensed nuclei. When the DNA was examined on an agarose gel electrophoresis, it was shown to be fragmented. [29]

On topical administration of O. sanctum leaf extract, papilloma genesis caused by 7,12dimethylbenz (a) anthracene (DMBA) substantially decreased tumour incidence in mice. The use of *Tulsi* extracts as a paste in the prevention of DMBA-induced buccal pouch carcinogens has shown encouraging effects. [30] *Tulsi* leaves were administered to experimental rats with 600 mg/g diet for 10 weeks and dramatically decreased the incidences of 3,4-benzo (a) pyrene [B (a) P] and 3‘methyl4 dimethylaminoazobenzene (3‘MeDAB) caused squamous cell carcinoma and hematoma. [31]

N-methyl-N′nitroN-nitrosoguanidine (MNNG), a nitroso chemical extensively employed as an experimental stomach carcinogen, has also been shown to lower the incidence of cancer produced by 70 percent ethanolic*Tulsi* leaf extract. MNNG is a powerful mutagen that causes erosions of the gastric mucosa, an early precancerous alteration required for stomach carcinogenesis to begin. MNNG administered intragastrically causes enhanced cell proliferation and angiogenesis while avoiding apoptosis, resulting in welldifferentiated squamous cell carcinomas. [32]

Tulsi extract has been demonstrated to impact the key molecules involved in cell proliferation, invasion, angiogenesis, and apoptosis, and has been shown to reduce these activities. There was a significant decrease in the levels of cytokeratin (CK) (infiltration), vascular endothelial growth factor (VEGF) (angiogenesis), proliferating cell nuclear antigen (PCNA), glutathione-S-transferase pi (key proteins involved in proliferation), and antiapoptotic protein Bcl-2, with a simultaneous increase in the proapoptotic proteins Bax, cytochrome c, and caspase 3 [33]

Studies further show that the leaf extract prevents metabolic activation of the procarcinogen to carcinogen, thereby blocking or suppressing the biochemical processes associated with chemical carcinogenesis. [34] Previous research has found that taking AlE from *Tulsi* leaves before taking 7,12 dimethylbenz[a] anthracene induces a drop in phase I enzymes, a decrease in lipid and protein oxidation, and an increase in antioxidant and phase II enzyme activity in the liver. *Tulsi* also reduces 7,12dimethylbenz[a] anthracene-induced genotoxicity in mice, as measured by the development of micronuclei in bone marrow cells.

These findings show that *Tulsi* has antigenotoxic effects in conjunction with the regulation of phase I and II detoxification enzymes, and that all of this may have contributed to the decrease of chemical carcinogenesis. [35]

Tulsi reduced the expression of cutaneous-glutamyltranspeptidase (GGT), a tumour development marker, as well as glutathione-S-transferase-P, which is upregulated in chemically-induced hepatic tumours. The concentration of the heat shock protein, which is changed during carcinogenesis, has also decreased. [36]

The activity of ornithine decarboxylase, an enzyme implicated in the control of cell proliferation and cancer formation, was reduced when *Tulsi* extract was applied. There was also a reduction in phase I enzymes and lipid peroxidation, suggesting that O. sanctum inhibits the activity of carcinogen-induced cytochrome P450-dependent enzymes, resulting in a reduction in the production of ultimate carcinogenic moiety. [37]

Activity that is radio protective

The radio protective action of O. sanctum was first discovered in 1995. When compared to synthetic radio protectors, two isolated flavonoids from O. sanctum leaves, vicenin and orientin, had a greater radio protective effect. When O. sanctum leaf extract was combined with WR-2721 (a synthetic radio protector), bone marrow cell protection was increased while WR-2721 toxicity was reduced. [38] On experimental animals, research on the radioprotective qualities of *Tulsi* extracts was done, and it was discovered that the water extract of *Tulsi* had more radio protective action than the alcoholic extract. The best dose of water extract was discovered to be 10 mg/kg.

Mechanism of anticancer action

The production of reactive oxygen species, mitochondrial permeability, the release of cytochrome c, and a reduction in the levels of the antiapoptotic protein bcl-2 all aided eugenol-induced apoptosis.[39,40] Because ethanolic extract is nonpolar, it always contains varying amounts of eugenol, luteolin, ursolic acid, and oleanolic acid. [41] Experimental research has demonstrated that eugenol and luteolin have anticancer properties in vitro.epending on the concentration, luteolin can act as an antioxidant or a pro-oxidant biochemically.

The anticancer properties of luteolin have been linked to the activation of apoptosis, suppression of cell proliferation, angiogenesis, and metastasis in several studies. Luteolin inhibits cell survival pathways such as NF-B, phosphatidylinositol 3′kinase (PI3K)/Akt, and Xlinked inhibitor of apoptosis protein (XIAP) while simultaneously stimulating apoptosis pathways, including those that activate the tumour suppressor gene p53. [42]

Toxicity

The median lethal dosage (LD50) of O. sanctum fixed oil was determined in mice following intraperitoneal injection. The fixed oil was well tolerated up to 30 ml/kg, but a dosage of 55 ml/kg resulted in 100 percent death. Oil has an LD50 of 42.5 ml/kg. The investigation of O. sanctum fixed oil at a dosage of 3 ml/kg/day, intraperitoneal for 14 days in rats revealed no adverse effects on subacute toxicity.

DISCUSSION

An annual delicate plant widely cultivated in the country's tropical environment. Because it is considered sacred in Hindu philosophy, it is also used in the kitchen garden and as an interior plant. The leaves are employed in a variety of traditional and home-made medicinal treatments.Basil is revered as a sacred herb in Hindu mythology. Perhaps the herb's genuine health benefits account for its prominence. It is indicated for usage as a first-aid therapy for respiratory, digestive, and skin ailments. Ayurveda acknowledges its usage for disorders ranging from ordinary ailments to tumorous growths, in addition to these common ailments. It has been found to be a highly

promising immuno-modulatory, Cytoprotective, and anticancer agent in investigations.[43]

CONCLUSION

Tulsi is clearly a medicinal plant of considerable value, as seen by its numerous medical applications, and can thus be aptly dubbed the "Queen of Herbs." It is apparent from this study that much work has been done in the field of medicine to use *Tulsi*'s qualities in allopathic treatment. The majority of the research is based on animal studies; therefore, further human clinical trials are needed to identify the specific benefits and other pharmacological characteristics of *Tulsi*.

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