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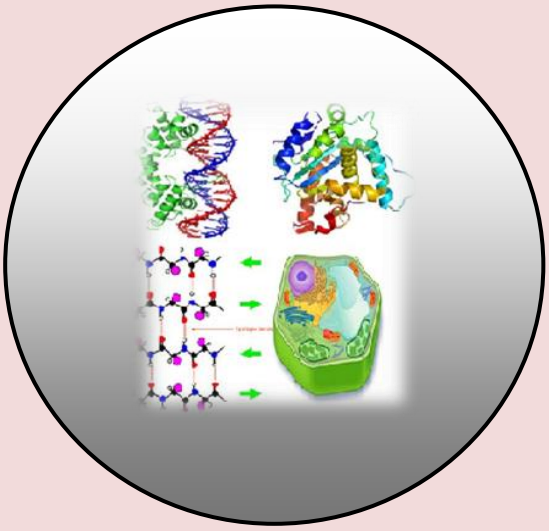
ISSN 2319-3077 Online/Electronic
ISSN 0970-4973 Print

UGC Approved Journal No. 62923
MCI Validated Journal
Index Copernicus International Value
IC Value of Journal 82.43 Poland, Europe (2016)
Journal Impact Factor: 4.275
Global Impact factor of Journal: 0.876
Scientific Journals Impact Factor: 3.285
InfoBase Impact Factor: 3.66

J. Biol. Chem. Research
Volume 36 (1) 2019 Part D, Pages No. 246-252



Journal of Biological and Chemical Research

An International Peer Reviewed / Referred Journal of Life Sciences and Chemistry

Indexed, Abstracted and Cited in various International and National Scientific Databases

Published by Society for Advancement of Sciences®

J. Biol. Chem. Research. Vol. 36, No. 1: Part D, 246-252, 2019
(An International Peer Reviewed / Refereed Journal of Life Sciences and Chemistry)
Ms 36/01/7888/2019

ISSN 2319-3077 (Online/Electronic)
ISSN 0970-4973 (Print)

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REVIEW ARTICLE
Received: 20/04/2019 Revised: 29/05/2019 Accepted: 30/05/2019

Evaluation of Boilogical Activities of Phytochemicals from Indian Medicinal Plant Tulsi

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ABSTRACT

In traditional system of medicine, different parts (leaves, stem, flower, root, seeds and even whole plant) of Ocimum sanctum Linn. have been recommended for the treatment of bronchitis, malaria, diarrhea, dysentery, skin disease, arthritis, eye diseases, insect bites and so on. The Basil or Tulsi plant has many medicinal properties. The leaves strengthen the stomach and help in respiratory diseases. Tulsi has been found to protect organs and tissues against chemical stress from industrial pollutants and heavy metals, and physical stress from prolonged physical exertion, ischemia, physical restraint and exposure to cold and excessive noise. Ayurveda traces its origin to the Vedas particularly Atharvaveda and it stresses the use of indigenous plant based medicines for the treatment of diseases [Patwardhan et al., 2005]. Tulsi extracts and its various bio-organic constituents showed anti-fertility, anticancer, antidiabetic, antifungal, antimicrobial, cardioprotective, analgesic, antispasmodic and adaptogenic activity. Different parts of the plant are used in Ayurveda and Siddha systems of medicine for prevention and cure of many illnesses like cough, influenza, common cold, headache, fever, colic pain, bronchitis, asthma, hepatic diseases, fatigue, skin diseases, arthritis and digestive disorders.
Keywords: Ayurveda, Holy basil, Eugenol, Ocimum sanctum, Phytochemicals and Tulsi.

INTRODUCTION

Indian medicinal plants have been used in successful management of various disease conditions like bronchial asthma, chromic fever, cold cough, malaria, dysentery, convulsions, diarrhea, arthritis, emetic syndrome, skin diseases, insect bite etc. and in the treatment of gastric, hepatic, cardiovascular and immunological disorders [Chopra, 1958, Tewtrakul et al., 2000, Sawangjaroen et al., 2005, Sawangjaroen et al., 2006, Rahman et al., 2005, Morikawa et al., 2004, Mohan et al., 2011, Ghosh et al., 1995]. In the developing world, plant-based traditional medicines are demanded by approximately 3.4 billion people. This number makes up 88% of the overall inhabitants in the world, where traditional medicine is their main approach for primary health care. Tulsi, "*Ocimum sanctum*," is part of the basil family that is indigenous to India.

Tulsi, also known as holy basil, is sacred in the Hindu religion because it's believed to be the reincarnation of the Hindu goddess Tulsi. It is widely used in the Ayurveda system of medicine to cleanse the respiratory tract, promote healthy digestion and relieve gas. Tulsi is pungent and bitter in taste, pungent in the post digestive effect and has hot potency.

Holy basil is many branched, fragrant and erect plant attaining a height of about 30-60 cm (12-24 in) with hairy stem. Its aromatic leaves are simple, opposite, elliptic, oblong, obtuse or acute with entire or sub serrate or dentate margins, growing up to 5 cm long. The purplish flowers are placed in close whorls on elongate racemes. Stalk less heart-shaped bracts are there at the base of each flower cluster. Sepal cup is not hairy within. Flowers are rarely longer than 5 mm, calyx tube bearded outside near base. The fruits are small and the seeds yellow to reddish in colour [Sen, 1993]. The parts of the plants of this species, such as grains or seeds, fruits, flowers, barks, stems, rhizomes, roots, and leaves, are utilized to regulate and treat diseases, as there are chemical components in them which are medically active.

Hindi Name: Tulsi
Sanskrit Name: Tulasi
English Name: Holy Basil
Latin Name: *Ocimum sactum* Linn Pennel

Holy basil is believed to help strengthen the immune system and can help reduce the signs of aging by regulating stress, increasing immunity and eliminating free radicals. Additionally, Tulsi leaves provide a range of nutrients including vitamins A and C, calcium, zinc, iron and chlorophyll. Alternative medicine practitioners use Tulsi as a powerful adaptogenic herb (an herb that reduces stress and increases energy). Adaptogenic herbs have been used in Ayurvedic medicine for thousands of years to promote and support health.

The name Tulsi is derived from “Sanskrit”, which means “matchless one” [9]. Its other name, Vishnupriya means the one that pleases Lord Vishnu. Tulsi is also known as "the elixir of life" since it promotes longevity. Among the plants known for medicinal value, the plants of genus Ocimum belonging to family Labiate are very important for their therapeutic potentials. *Ocimum sanctum* L., *O. gratissimum*, *O. canum*, *O. bascilicum*, *O. kilimandschricum, O. americanum, O. camphora* and *O. micranthum* are examples of known important species of genus Ocimum that grow in different parts of the world and are known to have medicinal properties [Gupta et al., 2002, Chopra et al., 1956, Kothari, 2005]. Ocimum tenuiflorum (or *Ocimum sanctum* L.) includes 2 botanically and phytochemically distinct cultivars that include:

Rama Tulsi

Krishna Tulsi

Vana Tulsi

Rama Tulsi (also known as green leaf Tulsi): A green Tulsi with light purple flowers and an aromatic, clovelike scent and mellower flavor [Kothari et al., 2005].
Krishna Tulsi (also known as Shyama Tulsi or purple leaf Tulsi): A purple plant with a clovelike aroma and peppery flavor [Parrotta, 2001].
Ocimum gratissimum is a third type of Tulsi known as **Vana Tulsi** (or wild leaf Tulsi): A bright, light green Tulsi plant that grows wild and is indigenous to many areas of Asia; it has a more lemony aroma and flavor [Orwa e al., 2009, Bhamra et al, 2015].

Of the three types of Tulsi, Krishna Tulsi is often considered to be the most beneficial to health, followed closely by Rama Tulsi. Vana Tulsi has less potency, but it is sometimes blended with other types of Tulsi for a more pleasing flavor. Preclinical studies have also shown that Tulsi and some of its phytochemicals eugenol, rosmarinic acid, apigenin, myretenal, luteolin, β–sitosterol, and carnosic acid prevented chemical-induced skin, liver, oral, and lung cancers and to mediate these effects by increasing the antioxidant activity, altering the gene expressions, inducing apoptosis, and inhibiting angiogenesis and metastasis. A Hindu household is considered incomplete if it doesn't have a Tulsi plant in the courtyard. Its use is recommended as a first aid in the treatment of respiratory, digestive and skin diseases. Chewing of Tulsi leaves also cures ulcers and infections of mouth [Prajapati et al., 2003]. A few leaves dropped in drinking water or food stuff can purify it and can kill germs in it. Holy Basil is so good for boosting up the immune system. It protects from nearly all sorts of infections from viruses, bacteria, fungi and protozoa. Recent studies show that it is also helpful in inhibiting the growth of HIV and carcinogenic cells [Kumar et al., 2012].
Apart from these common ailments, Ayurveda also recognizes its use for the diseases ranging up to tumerous growths. Tulsi has also been shown to counter metabolic stress through normalization of blood glucose, blood pressure and lipid levels, and psychological stress through positive effects on memory and cognitive function and through its anxiolytic and anti-depressant properties.

MATERIAL AND METHODS

Plant-based natural constituents can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds and so on [Gordon and David, 2001], that is any part of the plant may contain active components. Tulsi is cultivated for religious and tradition medicine purpose, and for its essential oil. All parts of Tulsi are used in medicine, especially fresh and dried leaves. According to the Journal of Ayurveda and Integrative Medicine, holy basil has antidepressant and anti-anxiety properties comparable to diazepam and antidepressant drugs. These studies examined the leaves. The leaves contain an essential oil[20], which contains eugenol, eugenal, carvacrol, methylchavicol, linalool, limatrol, ursolic acid, apigenin, luteolin, orientin and caryophylline. The nutritional and pharmacological properties of the whole herb in its natural form, as it has been traditionally used, result from synergistic interactions of many different active phytochemicals. The leaves of the basil are also effective in reducing mouth ulcer and other infections of the mouth. Its leaves are helpful in sharpening memory and in curing fever and common cold. The seeds contain oil composed of fatty acids and sitosterol; in addition, the seed mucilage contains some levels of sugars and the anthocyans are present in green leaves. The sugars are composed of xylose and polysaccharides. The roots contain sitosterol. Plant shows healing properties in hepatic injury and gastric ulcer. It relieves from stress, restore and improve body immunity and digestion. One study found that people who took 500 milligrams (mg) of holy basil extract each day felt less anxious, stressed, and depressed. People also felt more social.

Tulsi oil is also used as ear drops in case of pain. Tulsi improves the body's overall defence mechanism including its ability to fight viral diseases. It was successfully used in combating Japanese Encephalitis and the same theory applies to swine flu. Tulsi can help in speeding up the recovery process and also help in strengthening the immune system of the body [Pandey Govind, 2009, Kelm et al., 2000]. The stem and leaves of holy basil contain a variety of constituents that may have biological activity, including saponins, flavonoids, triterpenoids, and tannins [Jaggi e al., 2003]. In addition, the following phenolic actives have been identified, which also exhibit antioxidant and antiinflammatory activities: Rosmarinic, apigenin, cirsimaritin, isothymusin and isothymonin. Two water-soluble flavonoids [Uma Devi et al., 2000] Orientin and Vicenin have shown to provide protection against radiation-induced chromosomal damage in human blood lymphocytes. Ethanolic extract of *O. sanctum* L. significantly decreases the blood glucose, glycosylated hemoglobin and urea with a concomitant increase in glycogen, hemoglobin and protein in streptozotocin-induced diabetic rats [Narendhirakannan et al., 2006].

RESULT AND DISCUSSIONS

The World Health Organization has recommended that traditional health and folk medicine systems be integrated with modern medical therapies to more effectively address health problems worldwide. Ayurveda's use of medicinal and culinary herbs draws upon India's incredible biodiversity with a variety that is unsurpassed by any medical system; yet, of all the herbs used, none has a status comparable to Tulsi or holy basil (*Ocimum sanctum*). Within Ayurveda, Tulsi is known as "The Incomparable One," "Mother Medicine of Nature" and "The Queen of Herbs," and is revered as an "elixir of life" that is without equal for both its medicinal and spiritual properties [Singh et al., 2010]. We are in the midst of a global pandemic of obesity, diabetes, cancer, dementia, depression and other chronic diseases caused by modern lifestyles and their associated lack of physical activity, high intake of sugar, fat, salt, alcohol and tobacco and exposure to a toxic cocktail of industrial chemicals. Tulsi can be used to treat indigestion, intestinal parasites, ulcers, vomiting, gastric disorders, and stomach or menstrual cramps. It may also reduce pain from kidney stones and could help prevent them. Tulsi is an age-old ingredient for treating fever. It is one of the prime ingredients in the formulation of various ayurvedic medicines & home remedies. The fresh juice of Tulsi taken with black pepper powder cures periodic fevers. In case of acute fevers, a decoction of the leaves boiled with powdered cardamom in half a liter of water and mixed with sugar and milk brings down the temperature.

Studies using diabetic laboratory animals have shown that Tulsi can reduce blood glucose, correct abnormal lipid profiles [Ahmad et al., 2012, Singh et al., 2012] and protect the liver and kidneys from the metabolic damage caused by high glucose levels [Suanarunsawat et al., 2005]. Tulsi may relieve symptoms of asthma, bronchitis, colds, congestion, coughs, flu, sinusitis, sore throat, and similar ailments. Due to the presence of compounds like camphene, eugenol, and cineole, Tulsi cures viral, bacterial, and fungal infections of the respiratory system. Tulsi has been shown to protect against the toxic effects of many pharmaceuticals drugs including acetaminophen, [Makwana and Rathore, 2011] meloxicam, [Mahaprabhu et al., 2011] paracetamol, [Lahon and Das, 2011] haloperidol [Pemminati et al., 2007] and anti-tubercular drugs [Ubaid et al., 2003].

Tulsi has also been shown to prevent weight gain, hyperglycemia, hyperinsulinemia, hypertriglyceridemia and insulin resistance. The medicinal properties of Tulsi have been studied in hundreds of scientific studies including *in vitro*, animal and human experiments.

These studies reveal that Tulsi has a unique combination of actions that include: Antimicrobial (including antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, anthelmintic), mosquito repellent, anti-diarrheal, anti-oxidant, anti-cataract, anti-inflammatory, chemopreventive, radioprotective, hepato-protective, neuro-protective, cardio-protective, anti-diabetic, anti-hypercholesterolemia, anti-hypertensive, anti-carcinogenic, analgesic, anti-pyretic, anti-allergic, immunomodulatory, central nervous system depressant, memory enhancement, anti-asthmatic, anti-tussive, diaphoretic, anti-thyroid, anti-fertility, anti-ulcer, anti-emetic, anti-spasmodic, anti-arthritic, adaptogenic, anti-stress, anti-cataract, anti-leukodermal and anti-coagulant activities [Mahajan et al., 2013, Mohan et al., 2011, Pattanayak et al., 2010, Mondal et al., 2009]. These pharmacological actions help the body and mind cope with a wide range of chemical, physical, infectious and emotional stresses and restore physiological and psychological function. The Imperial Malarial Conference has declared Tulsi to be a genuine remedy for malaria. Holy basil contains vitamin C and antioxidants such as eugenol, which protects the heart from the harmful effects of free radicals. Eugenol also proves useful in reducing cholesterol levels in the blood. Regular consumption of Tulsi may lower blood pressure and cholesterol by regulating cortisol levels, reducing the risk of stroke, heart attack, and other related diseases. It can also help relieve headaches and may lessen anxiety and depression. Tulsi may kill damaging bacteria in the mouth, resulting in cleaner teeth and fresher breath. It can also alleviate acne, slow the effects of aging, and relieve the itch or sting of bug bites. Tulsi is good for eyes and night blindness. To have good result 1 or 2 drops of basil juice are put into eyes.

ACKNOWLEDGEMENTS

The author is highly grateful to Professor J.P.N. Chansouria, Center of Experimental Medicine and Surgery, Professor V.B. Pandey, Professor V.P. Singh, Department of Medicinal Chemistry, Institute of Medical Sciences, BHU, for their valuable suggestions. Here I would like to specify my source of the context in the article i.e., the internet, which helped me to putting forth this article to people around the world.

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