Review Article



The Tulsi, Queen of Green Medicines: Biochemistry and Pathophysiology – A Review

Ashok Kumar Sah^{1&2}*, M Vijaysimha², Md. Mahamood³

Department of MLT, Amity Medical School, Amity University, Haryana, India.
 School of Life & Allied Health Sciences, Glocal University, Saharanpur, UP, India.
 Department of Zoology, Aligarh Muslim University, Aligarh, UP, India.
 *Corresponding author's E-mail: ashok.sah8@gmail.com

Received: 28-04-2018; Revised: 21-05-2018; Accepted: 11-06-2018.

ABSTRACT

Tulsi (*Ocimum sanctum*) is one of the oldest aromatic herbs of the family *Lamiacaceae*. It is popularly known as "holy basil or sacred basil" and is present in almost every household in Indian sub-continent due to its medicinal, nutritional and spiritual properties. It is also known as "the incomparable one, mother of natural medicine and the queen of herbs." It has great medicinal importance. The leaves and flowers have good nutritional sources of fatty acid, β -carotene, calcium, vitamin C, and volatile substances which maintain our body healthy. Hindus use the wood or seeds of tulsi to make garland, which are strings of beads used to help in meditation, focusing of mind, chanting a devotional practice which connects the body, mind and spirit. This review focuses on the beneficial effects such as medicinal, nutritional and spiritual properties of tulsi.

Keywords: Tulsi, Green medicines, Sacred, Basil, Medicinal herbs, Ocimum sanctum.

INTRODUCTION

ulsi (Ocimum sanctum) is a highly aromatic herb of the family Lamiacaceae. It is popularly known as "holy basil or sacred basil" and is present in almost every household in Indian sub-continent mainly because of its medicinal, nutritional and spiritual properties. It is also given other names like "the Incomparable one, mother of natural medicine and the queen of herbs." In Hinduism, it is worshipped as a goddess and every part of the herb is revered and considered sacred. It is regarded as deity or holy basil in Indian sub-continent. A Hindu's household is considered incomplete without a tulsi plant. It is further integrated into various purposes not only in morning and evening rituals but also in other spiritual, purification practices. It is even believed that it is also believe that it protects family and house from bad effects. Leaves can also be used for consumption as tea. Hindus use the wood or seeds of tulsi to make garland (malas), which are strings of beads used to help in meditation, focusing of mind, chanting a devotional practice which connects the body, mind and spirit. It is considered that god Bramha resides in the roots, god Vishnu resides in leaves and stem and god Rudra resides in flowering tops. It strengthens faith, compassion and clarity. It is required in every worship in Hindu culture to satisfy gods and goddesses. Many of Hindu people, in spite of availability of tulsi in their surroundings, don't know full beneficial effects of it. Therefore, this review focuses on the beneficial effects such as medicinal, nutritional and spiritual properties of tulsi. This review also emphasizes disadvantage. 1-3

It is observed that daily consumption of its leaves and its products is considered to prevent diseases, promote health, longevity, wellbeing and helps to reduce the physical and mental stresses of daily life. It is recommended as a treatment for various conditions which includes anxiety, fever, cough, dysentery, asthma, arthritis, eye diseases, back pain, skin diseases, gastric, vomiting, cardiac diseases, genitourinary disorder, hiccups, ringworm, insect bite, malaria, otalgia, common cold, indigestion, constipation, headache, respiratory disorder, diabetes and other health abnormal conditions.⁴⁻⁷ The strong medicinal properties have been studied in many scientific reports including various experimental works in animals as well as human. These studies found that it has unique medicinal effects that include anti-inflammatory, anti-pyretic, anti-allergic, antiasthmatic, anti-tussive, anti-ulcer, anti-emetic, antispasmodic, mosquito repellent, anti-diarrheal, antioxidant, anti-stress, hepato-protective, cardio-protective, neuro- protective, anti-hypercholesterolemia, antidiabetic, anti-coagulant activity, adaptogenic, antithyroid, anti-cataract, anti-carcinogenic, radioprotective, anti-hypertensive, analgesic, immunomodulatory, CNS depressant, memory enhancement, diaphoretic, antifertility, anti-leucodermal, anti-ulcer, antimicrobial (includes anti-viral, antibacterial, antifungal, antiprotozoal, antimalerial, antihelmenthic), anti-arthritic, anti-toxic, wound heal effect.⁸⁻¹³ Herbal medicine, as the major constituents of traditional as well as modern medicinal system has created a major contribution to maintain human health system. Most of the world's population in developing countries still believes that herbal medicine is one that meets human health needs.¹⁴

The leaves of tulsi are used in temples for the worship purposes and also on several social functions like marriage, death, decoration etc. According to one story, it was a 'gopi' who fell in love with Krishna and so had a



106

curse laid on her by her consort Radha. She was very dear to Vishnu. Tulsi is also mentioned in the stories of Mira and Radha immortalized in Jayadeva's Gita Govinda. A hindu house is considered incomplete without the Tulsi plant in the courtyard. In India, it is worshipped in a special month in 'Kartik' which begins after Sharad Poornima and also called as 'Tulsi vivah' (marriage). On this day, it is ornamented and beautified as a bride. Women water the plant, light up the diya near it and worship it daily. The leaves, stems, seeds and even the soil are regarded as sacred. According to the ancient textual matter, it is respected as the one who helps in fetching people closer to the almighty.¹⁵

Chemical Constituents

Chemical constituents of tulsi are α -pinene, α -thujene, Nonane, Octane, Benzene, (Z)-3-hexanol, Ethyl 2-methyl butyrate, β -pinene, Toluene, Camphene, Citronellal, Sabinene, Dimethyl benzene, Myrecene, Ethyl benzene, Limocene, cis- β -ocimene, 1,8,-cineole, p-cymene, Allo-ocimene, Terpiniolene, Butyl-benzene, Linalool, α cubebene, Eugenol, Methyl eugenol, β -elemene, (E)- cinnamy, Iso-eugenol, Lactate, Isocaryophyllene, βcaryophyllene, α -guaiene, α -amorphene, α -humulene, γ humulene, 4,11- Carvacro, Seinadiene, α-terpeneol, αselinene, Isoborneol, , Borneol, germacrene-D, β-selinene, Myrtenylformat, Geraneol, α -murolene, Calamene, cadinene, δ-Cuparene, Nerolidol, Iedol, Caryophyllene oxide, Elemol, Tetradecanal, Humulene oxide, α- guaiol, τ -cadinol. α - bisbolol. (EZ)-famesol. Cissesquisainene Selin-11-en-4- α -ol, 14-hydroxy- α -humulene. hydrate, Urosolic acid, Luteolin, Apigenin, Apigenin-7-Oglucuronide. Vicenin-2. Luteolin-7-O-glucuronide, Isorientin, Orientin, Molludistin, Stigmasterol, Triacontanol ferulate, Vitexin, Aesculin, Isovitexin, Procatechuic acid, Aesculetin, Chlorgenic acid, Galuteolin, Circineol, Gallic acid, gallic acid methyl ester, Vallinin acid, 4-hydroxybenzoic acid, Caffiec acid, Chlorogenic acid, β-Stigmasterol, Phenylpropane glucosides. Palmitric Acid, Linolenic Acid, Stearic Acid, Sitosterol, Oleic Acid, Dilinoleno-linolins, Linodilinolin, Hexourenic acid. ^{13, 16-22}

MINERALS

Sn.	Nutritional Components	Contents (per 100g)			
1	Carbohydrate	2.3g			
2	Calcium	25mg			
3	Carotene	2.5µg			
4	Chromium	2.9 μg			
5	Copper	0.4 μg			
6	Fat	0.5mg	2, 22, 23		
7	Iron	15.1mg			
8	Nickel	0.73 μg			
9	Phosphorus	287mg			
10	Protein	4.2g / 30kcal			
11	Vitamin C	25mg			
12	Vanadium	0.54 μg			
13	Zinc	0.15 μg			

Table 1: Nutritional components of Ocimun sanctum

Advantages

Table 2: Advantages of constituents of Ocimum sanctum.

Sn.	Constituents	Advantages
1	Apigenin	Neurogenesis stimulator, Anti- cancer agents. 24-26
2	Bisabolol	Perfumery, Cosmetic agents, Wound healing, Anti-inflammatory, Antimicrobial, Anti-irritant, Anti-cancer agent. ²⁷⁻²⁹
3	Borneol	Essential oil, Insect repellent. ³⁰
4	Caffeic Acid	Anti-cancer, Antioxidant, Antifungal, Matrix of Mass Spectrophotometry analyzer. 31-34
5	Calamine	Dermatological medicines. 35-36
6	Carvacrol	Antibacterial agent, Pleasant taste & odor, Flavoring agent. 37-39
7	Caryophyllene	Anti-inflammatory agent, Neuroprotective agent, Antinociceptive agent, Antidepressant agent, Anxiolytic agent, Anti- alcoholic agent. 40-45
8	Chlorogenic Acid	Green Tea, Anti-hypersensitive drugs. 46-50



International Journal of Pharmaceutical Sciences Review and Research

Available online at www.globalresearchonline.net

9	Cineole	Spice, Perfumery, Flavoring, Cosmetics, Beverages, Cigarette, Mouth Wash, and Body powder, Insect repellent, Insecticidal. ⁵¹⁻⁵⁷
10	Cinnamon	Flavoring agents (Fireball cinnamon whisky), Spices, Chocolate. ⁵⁶
11	Cubeb	Medicines (Pharyngitis, Asthma, Hay fever). 58
12	Elemene	Anti-cancer agent. 59
13	Esculetin	Anticoagulant, Sunscreen cream, Medicine (Varicose vein), Diagnostic use (Blue Flurochrome). 60-63
14	Eugenol	Flavoring agent, Perfumes, Essential Oil, Anesthetic, Antiseptic, Dental product, Antibacterial agent. ^{8, 64-65}
15	Fernesol	Deodorant, Cosmetics, Antibacterial agents, Anti-fungal agent. 29, 66-67
16	Gallic Acid	Enzymes for biochemical reaction, Neurogenerative, Anti- cancer agents. 68-72
17	Geraniol	Mosquito repellent, Flavoring agents, Perfumery. ⁵⁴⁻⁵⁸
18	Guaienes	Perfumery Spices, Flavoring agents. ⁷³
19	Hexuronic Acid	Source of Vitamin C. ⁷⁴
20	Humulene	Anti-inflammatory. ³⁰
21	Hydroxybenzoic Acid	Antioxidant, Precursors of estrogen, Carcinogens. ⁷⁵⁻⁷⁹
22	Limonene	Cosmetic products, Flavoring agent(food), Perfumery, Shaving lotion, Bath products, Insecticidal agents, Cleaning agent, Medicine, Constituents of glue and paints, Air freshener, Filament fused 3D printing, Combustible bio-fuel, Diagnostic (section cutting), Substitute for xylene. ⁸⁰⁻⁸⁵
23	Linalool	Perfumery, Cleaning agent (Shampoo, detergent, soap, lotion), Vitamin E, Insecticidal, mosquito repellent, Anti- inflammatoryctivity, Analgesic and antihyperalgesic. ^{51, 86-89}
24	Myrcene	Odorant, Perfumery. 90
25	Ocimene	Perfumery, Anti-fungal agent, Anti- bacterial agent, Antiseptic. 59
26	Phellodendron	Medicine (Urological & prostate disorders), Anti-cancer agent, Vitamin E, Antioxidants. 90-93
27	Pinene	Anti-inflammatory, Bronchodialator, Antimicrobial agent, Antifungal agent, Mosquito repellent. 91-94
28	Protocatechuic Acid	Antioxidant, Anti-inflammatory, Green Tea, Anti-cancer, antifungal, Flavoring agent. ⁹⁵⁻⁹⁸
29	Stigmasterol	Precursors or hormones androgen, estrogen, cortisol, Anti-cancer agent, Hyperglycemic agents, Antioxidant, Anti-thyroids, Precursors of boldenone (Veterinary medicine). ⁹⁹⁻¹⁰⁷
30	Terpineol	Pleasant odor, Flavoring agent, Perfumery, Cosmetic products, Lap sang souchong tea. ^{92,108-109}
31	Urosolic Acid	Anti-cancer agents, medicine (Hepatoprotective), Immune enhancers, Anti-diabetic agents, Cosmetics. ^{19,110-116}
32	Vanillic Acid	Wine & vinegar, Green Tea, Analeptic drugs. 117-119, 121-123
33	Vitexin	Anti-cancer, Antioxidant, Anti- hyperglycemic, Anti-inflammatory, Neuroprotective. 100,120-121, 124-126

Disadvantages

The high dose of tulsi and its products affects the reproductive health of both males and females. Its effects are reduction in sperm count, mortality of sperm and low weight of testes. It is also observed that there is antiestrogenic activity. The side effects in females include uterine contraction in pregnant women leading to abortion. It also affects lactation. Backache, cramps, diarrhea, bleeding etc. are also observed in females. Lead poisoning, dental problem due to lead, hypoglycemia, prolonged bleeding time, thin bloods are the important side effects of tulsi observed from scientific studies. It is hepatotoxic in nature (Eugenol).^{1122-125, 127-130}

Effects of Tulsi in Medicine

Anti-Cancer

Anti-carcinogenic effects of tulsi has been studied on various animal models using different types of carcinogens and it was found to be effective against liver, pancreas, lungs, brain, skin, bone marrow, uterine, cervical, peptic ulcer, gastric ulcer, bladder, leukemia, breast cancer etc. Tulsi has strong anti-carcinogenic effects due to the presence of eugenol, urosolic acid, oleanlic acid, ethanolic extract in tulsi products. The studies also showed that the effects against carcinogenic gene, modulation of carcinogen and inactivation of enzymes which are responsible for cancer such as cytochrome P-450, cytochrome b5 and hydrocarbon hydroxylase. It also prevents from cancer causing



108

compounds that induce apoptosis and damaging of genetic materials.¹²⁶⁻¹²⁸

Antioxidant

Various scientific and experimental studies have shown that it protects toxic effects of various environmental and chemical induced injuries and damage by increasing body's level of anti-oxidant bio-molecules such as glutathione and increase the activity of anti-oxidant enzymes like catalase, superoxide dismutase, glutathione-S-transferase which protect cellular components by mopping up damage from free radicals caused by hypoxia and other chemicals. It has strong effects on mental and physical stress, metabolism, hypoxia, oxidation-reduction potential, respiration, physical and biochemical parameters caused by physical stressors, peroxidative damage due to essential oils, eugenol, carvacrol, methyl chavicol, limitol cariophylline, urosolic acid, beta tracontanol which are present in leaves of Tulsi. It is a very good CNS stimulant.^{11, 129-132}

Anti-Diabetic

The leaves of *O. sanctum* are proved to possess antidiabetic effects in various experiments on animals. The anti-diabetic effects of Petroleum Ether (pet-ether), Ethyl Acetate (Et-Ac) and Chloroform fraction of ethanolic extract of *O. sanctum* were assayed in normal and Alloxan induced Diabetic rats and the effects on fasting glucose level, cholesterol, triglycerol, SGOT, SGPT and Serum glutamate oxaloacetate transaminase level content were investigated and observed significantly reduced.¹³³ These results show that different fractions of leaf of tulsi have highly effective properties to reduce the severity of diabetes and hepatitis. The constituents of *O. sanctum* leaf extract enhance the physiological pathways in insulin secretion which is the marker of anti-diabetic effects.¹³⁴⁻

Cardio-protective

It is reported to possess potential cardioprotective properties. The cardioprotective activity of *O. sanctum* has been attributed largely to the antioxidant properties associated with its flavonoid and phenolic constituents, which are known to augment GSH and antioxidant enzyme levels and scavenge lipid peroxides. Prolonged oral use of fresh *O. sanctum* protects isoproterenol induced myocardial necrosis in rats. The induction of drug used oxygen radicals in heart cells led to cardiac lipid membrane peroxidation. Urosolic Acid isolated from *O. sanctum* has been shown to be a very good protector against Adriamycin induced lipid peroxidation. Urosolic acid has strong effects on protection of heart^{10,136-138}

Antimicrobial

It has been shown that the extract of *O. sanctum* has strong effects against *E. coli, Shigella* sp., *Stephylococci* sp, *Streptococcus aureus, Enterobacteria, Pseudomonas aeroginosa, Salmonella typhi, Klebsiella pneumonia, Candia albicans, Mycobacterium tuberculosis, Proteus,* *Micrococuus pyogens, Vibrio cholera, Alternaria tenuis, Helminthosporium* sp, *Curvularia penniseli, Alterneria solani, Candida guillermondi, Collectrotricum capsici, Fusarium solani, Anthrobacter globiformis, Bacillus megaterium* and *Neisseria gonorrhoeae.* The fractions such as urosolic acid, oils, linoleic acid, eugenol have shown maximum antibacterial activities. The antibacterial effects have been compared with penicillin and ciprofloxacin. The essential oils and eugenol extract of O. *sanctum* have shown effective antinemic activities against *Caenorhabditis elegans.* The extracts of its leaves such as eugenol, triglyceride, essential oils have been effective against larvae of *Aedes aegypti, Culex fatigans, C. quinquefasciatus* and also found to be a potent larvicide against these microorganisms.^{18,139-145}

Radio-protective

The radioprotective effects of extracts of *O. sanctum* were reported by Ganasoundari and Devi in 1995. Aqueous extracts were effective in increasing survival, as compared to ethanol extract from dry leaves in lethal dose of radiation. It was also shown that the extract of *O. sanctum* was more effective against bone marrow damage as compared to other herbal extracts. Its extracts protect from gamma radiation and delay toxicity to chromosome of rats. It also protects from toxic radicals.¹⁴⁶⁻¹⁴⁸

Wound Healing

Several scientists, through their experiments have shown healing properties of *O. sanctum*. The cold aqueous extract has been reported very effective against wound healing and tumor necrosis factor α (TNF- α) on experiment in *Wistar albino* rats. Experimental animal treated with 10% leaf extract of *O. sanctum* with petroleum jelly gave more enhanced healing effects than other treatment and also found that increased level of tumor necrosis factor α (TNF- α) in *O. sanctum* treated animals. This method is still very common in rural areas.¹⁴⁹⁻¹⁵⁰

Antihistaminic, Anti anaphylactic and Mast cell stabilization

Various studies have shown that the treatment of asthma and related conditions with *O. sanctum* extracts were very effective and are still used for treatment of respiratory conditions. The antihistaminic and antianaphylactic activities of *O. sanctum* are mainly due to its inhibition of inflammatory mediators, suppression of IgE and mast cell stabilizing potential. *O. sanctum* leaves have strong effects of therapeutic activities.¹⁵¹

Antigenotoxic

O. sanctum leaf extract has modifying effects against Chromium and Mercury induced genotoxicity, and it was also shown that low dose of leaf extract was more effective than high dose of leaf extract. It was studied that human lymphocyte culture could reduce experimentally induced mitotic index, sister chromatid



exchange and replication index after treating with its leaf extract. $^{\rm 152 \cdot 154}$

Mental

There are reports that various extracts of leaf, stem and stem callus, flower and seed of *O. sanctum* were tested for the anticonvulsant activity by maximum and minimum electric shock model using phenytoin as standard. In those studies, researchers found that chloroform and ethanol extract of leaf, stem and stem calli were effective in convulsion induced by electric shock. They opined that extract of *O. sanctum* could be effective in the treatment of cognitive disorder such as Alzheimer's disease and dementia. Other studies showed that tulsi has significant effects on CNS bringing about antistress and anxiolytic effect that may involve the GABA system.¹⁵⁵⁻¹⁵⁷

Immunological

Several researchers have observed immunoregulatory properties of methnolic extract and aqueous suspension of *O. sanctum* to antigenic properties against salmonella and sheep erythrocytes. In those studies, compounds isolated from *O. sanctum* extract were found to have cyclooxygenase inhibitory activity and anti-inflammatory activity. Eugenol was found to have 97% cyclooxygenase inhibitory activity when assayed at 1000 μ M concentration of osmium sanctum extracts. Civsimavitin, Apigenin, Civsilineol and rosavinic acid also reportedly have cyclooxygenase inhibitory activity.^{2 & 158}

Mental stress

Modern life style has full of mental stress in all age groups in human beings due to physical, chemical and psychological stress. The psychotherapeutic properties of *O. sanctum* have been observed in various experimental animals. Tulsi has anti-depressant, anti-anxiety properties which can be compared to antidepressant drugs like Diazepam. In human studies it has been observed to reduce depression, anxiety and stress and protects against aging induced memory loss/deficit. In other animals, it reportedly enhances memory and cognitive activities.¹⁵⁹⁻¹⁶¹

CONCLUSION

It is observed from various scientific studies that Tulsi protects from many modern and traditional healthrelated disorders like radiation, stress, cancers, diabetes, aging, various infections not only in mankind but also in animals and plants. It enhances the immune system to adopt in any environment as adaptogen. It has many vital properties such as anti-stress, anti-cancers, anti-oxidants, anti-inflammatory, anti-microbial, anti-radiation, insecticidal, insect repellent, flavoring, coloring and many other uncountable properties. It has not only medicinal properties but also nutritional, spiritual properties which are only present in this plant; thus, it is regarded as "Queen of Green Medicines." **Acknowledgement:** The authors gratefully acknowledge the facilities provided to them by their respective heads of their departments.

REFERENCES

- Singh N, Hoette Y, Miller R, Tulsi: The Mother Medicine of Nature, 2nd ed. Lucknow: International Institute of Herbal Medicine, 2010. pp. 28-47.
- Pattanayak P, Ocimum sanctum Linn. A reservoir plant for therapeutic applications: An overview, Pharmacogn Rev, 4, 2010, 95-105.
- 3. Mahajan N, A phytopharmacological overview on Ocimum species with special emphasis on Ocimum sanctum, Biomed Prev Nutr, 3, 2013, 185-92.
- Mohan L, Ocimum sanctum linn. (TULSI)-an overview, Int J Pharm Sci Rev Res, 7, 2011, 51–3.
- Mondal S, Mirdha BR, Mahapatra SC, The science behind sacredness of Tulsi (Ocimum sanctum Linn.), Indian J Physiol Pharmacol, 53, 2009, 291–306.
- 6. World Health Organisation, Preventing Chronic Diseases: A Vital Investment: WHO Global Report, Geneva: World Health Organization, Department of Chronic Diseases and Health Promotion 2005, p. 18.
- Bast F, Rani P, Meena D, Chloroplast DNA phylogeography of holy basil (Ocimum tenuiflorum) in Indian subcontinent, Scientific World Journal, 1, 2014, 1-6.
- Shukla ST, Kulkarni VH, Habbu PV, Jagadeesh KS, Patil BS, Smita DM, Hepatoprotective and antioxidant activities of crude fractions of endophytic fungi of Ocimum sanctum Linn. in rats, Orient Pharm Exp Med, 12, 2012, 81–91.
- Wangcharoen W, Morasuk W, Antioxidant capacity and phenolic content of holy basil, Songklanakarin J Sci Technol, 29, 2007, 1407– 15.
- Panda VS, Naik SR, Evaluation of cardioprotective activity of Ginkgo biloba and Ocimum sanctum in rodents, Altern Med Rev, 14, 2009, 161–71.
- Shivananjappa M, Joshi M, Aqueous extract of tulsi (Ocimum sanctum) enhances endogenous antioxidant defenses of human hepatoma cell line (HepG2), J Herbs Spices Med Plants, 18, 2012, 331–48.
- Manikandan P, Ocimum sanctum Linn. (Holy Basil) ethanolic leaf extract protects against 7, 12-dimethylbenz (a) anthracene-induced genotoxicity, oxidative stress, and imbalance in xenobioticmetabolizing enzymes, J Med Food, 10, 2007, 495–502.
- Rahman MS, Salehin MF, Jamal MAHM, Pravin A, Alam MK, Antimicrobial activity of Argimone Mexicana L against water born microbs, Res J Med Plant, 5, 2011, 621-6.
- 14. Cohen MM, Tulsi Ocimum sanctum: A herb for all reasons, J Ayurveda Integr Med, 5 Suppl 4, 2014, 251-9.
- 15. Miller R, Miller S, Tulsi, Queen of Herbs, India's Holi Basil, Green Isle Interprizes 2003.
- Anbarasu K, Vijayalaxmi G, Improve shelf life of protein rich tofu using Osmium sanctum (Tulsi) extract to benefit Indian rural population, J Food Sci, 72, 2007, M300-05.
- Jaggi RK, Maddan R, Singh B, Anticonvualsant potential of holly basal, Osmium sanctum Linn. And its culture, Indian J Exp Biol, 41, 2003, 1329-33.
- Kelm MA, Nair GM, Mosquitocidal compounds and triglyceride 1, 3dilinolenoeol-2-palmitin from Osmium santum, J Agric Food Chem, 40,1998, 3691-3.



Available online at www.globalresearchonline.net

- Shisodia S, Urosolic acid inhibits auclear factor-kapa B activation induced by carcinogenic agents through suppression of Ikappa B alpha kinase and p65 phosphorylation: Correlation of down regulation of cyclooxygenase 2, matrix metaloprotease 9 and cyclin D1, Cancer Res, 63, 2003, 4375-83.
- Singh N, Verma P, Pandey BR, Bhalla M, Therapeutic Potential of Ocimum sanctum in prevention and treatment of cancer and exposure to radiation: An overview, Int J Pharm Sci Drug Res, 4, 2012, 97–4.
- 21. Summy S, Patyal P, Scimum Sanctum (Tulsi) "Queen of All Medicinal Herbs": A Review. IJIPSR, 4, 2016, 871-86.
- 22. Luthra D, Ocimum Sanctum (Tulsi): A Potent Medicinal Herb. Webmed Central pharmacology ,1, 2010, WMC001210
- Nissen L, Zatta A, Stefanini I, Grandi S, Sgorbati B, Biavati B, Monti A, "Characterization and antimicrobial activity of essential oils of industrial hemp varieties (Cannabis sativa L.)", Fitoterapia, 81, 2010, 413–9.
- Taupin P, Apigenin and related compounds stimulate adult neurogenesis. Mars, Inc., the Salk Institute for Biological Studies: WO2008147483", Expert opinion on therapeutic patents, 19, 2009, 523–7.
- Venigalla M, Sonego S, Gyengesi E, Münch G. Curcumin and Apigenin - novel and promising therapeutics against chronic neuroinflammation in Alzheimer's disease, Neural Regeneration Research, 10, 2015, 1181–5.
- Shukla S, Gupta S, Apigenin: a promising molecule for cancer prevention", Journal of Agricultural and Food Chemistry, 27, 2010, 962–78.
- Moser K, Kriwet K, Naik A, Kalia YN, Guy RH, Passive skin penetration enhancement and its quantification in vitro, Eur J Pharm Biopharm, 52, 2001, 103-12.
- 28. Kamatou GPP, Viljoen AM, A Review of the Application and Pharmacological Properties of α -Bisabolol and α -Bisabolol-Rich Oils, Journal of the American Oil Chemists' Society, 87, 2010, 1–7.
- Joo JH, Jetten AM, Molecular mechanisms involved in farnesolinduced apoptosis. Cancer Lett, 287, 2009, 123–35.
- 30. Passosa GF, Fernandesa ES, Anti-inflammatory and anti-allergic properties of the essential oil and active compounds from Cordia verbenacea. Journal of Ethnopharmacology, 110, 2007, 323–33.
- Rajendra PN, Karthikeyan A, Karthikeyan S, Reddy BV, Inhibitory effect of caffeic acid on cancer cell proliferation by oxidative mechanism in human HT-1080 fibrosarcoma cell line. Mol Cell Biochem, 349, 2011, 11–9.
- 32. Olthof MR, Hollman PC, Katan MB, Chlorogenic acid and caffeic acid are absorbed in humans. J Nutr, 131, 2001, 66–71.
- 33. Hirose M, Takesada Y, Tanaka H, Tamano S, Kato T, Shirai T, Carcinogenicity of antioxidants BHA, caffeic acid, sesamol, 4-methoxyphenol and catechol at low doses, either alone or in combination, and modulation of their effects in a rat medium-term multi-organ carcinogenesis model, Carcinogenesis, 19, 1998, 207–12.
- 34. Beavis RC, Chait BT. Cinnamic acid derivatives as matrices for ultraviolet laser desorption mass spectrometry of proteins. Rapid Commun. Mass Spectrom, 3, 1989, 432–5.
- 35. British national formulary: BNF 69, British Medical Association, 69 ed., 201, pp. 801.
- 36. Bakker P, Woerdenbag H, Gooskens V, Naafs B, Kaaij RVD, Wieringa N, Dermatological Preparations for the Tropics, A formulary of dermatological preparations and background information on therapeutic choices, production and dispensing, Beta Science Shop, University of Groningen, The Netherlands, 2nd revised edition, 2012.

- Du WX, Olsen CW, Avena-Bustillos RJ, McHugh TH, Levin CE, Friedman M, "Storage Stability and Antibacterial Activity against Escherichia coli O157:H7 of Carvacrol in Edible Apple Films Made by Two Different Casting Methods", J Agric Food Chem, 56, 2008, 3082–8.
- Ultee A, Smid EJ, "Influence of carvacrol on growth and toxin production by Bacillus cereus", Int J Food Microbiol, 64, 2001; 64, 373–8.
- Cox SD, Markham JL, Susceptibility and intrinsic tolerance of Pseudomonas aeruginosa to selected plant volatile compounds, J Appl Microbiol, 103, 2007, 930–6.
- Gertsch J, Leonti M, Raduner S, Racz I, Jian-Zhong C, Xiang-Qun Xi, Karl-Heinz A, Meliha K & Andreas Z, "B-caryophyllene is a dietary cannabinoid". Proceedings of the National Academy of Sciences of the United States of America, 105, 2008, 9099–104.
- 41. Katsuyama S, Mizoguchi H & Kuwahata H, "Involvement of peripheral cannabinoid and opioid receptors in β -caryophylleneinduced antinociception". European journal of pain, 17, 2013, 664– 75.
- 42. Guimarães S, Adriano. Copaiba Oil-Resin Treatment Is Neuroprotective and Reduces Neutrophil Recruitment and Microglia Activation after Motor Cortex Excitotoxic Injury, Evidence-Based Complementary and Alternative Medicine 2012; 1–9.
- Bahi A, Al Mansouri S, Al Memari E, Al Ameri M, Nurulain SM, Ojha S, "β-Caryophyllene, a CB2 receptor agonist produces multiple behavioral changes relevant to anxiety and depression in mice", Physiology & Behavior,135, 2014, 119–124.
- 44. Mansouri S, Ojha S, Al Maamari E, Al Ameri M, Nurulain SM, Bahi A, "The cannabinoid receptor 2 agonist, β-caryophyllene, reduced voluntary alcohol intake and attenuated ethanol-induced place preference and sensitivity in mice". Pharmacology, biochemistry, and behavior, 124, 2014, 260–8.
- 45. Javed H, Azimullah S, Haque ME, Ojha SK. Cannabinoid Type 2 (CB2) Receptors Activation Protects against Oxidative Stress and Neuroinflammation Associated Dopaminergic Neurodegeneration in Rotenone Model of Parkinson's Disease, Frontiers in Neuroscience, 10, 2016, 321.
- Onakpoya I, Terry R, Ernst E, "The use of green coffee extract as a weight loss supplement: A systematic review and meta-analysis of randomised clinical trials". Gastroenterology Research and Practice, 1, 2011, 1–6.
- Rio DD, Stalmach A, Calani L, Crozier A. Bioavailability of Coffee Chlorogenic Acids and Green Tea Flavan-3-ols. Nutrients, 8, 2010, 820–33.
- Freedman SO, Shulman R; Krupey J, Sehon AH, Antigenic properties of chlorogenic acid, The Journal of Allergy and Clinical Immunology, 35, 1964, 97–107.
- Zhao Y, Wang J, Ballevre O, Luo H, Zhang W, Antihypertensive effects and mechanisms of chlorogenic acids, Hypertens Res, 35, 2012, 370-4.
- Onakpoya IJ, Spencer EA, Thompson MJ, Heneghan CJ, The effect of chlorogenic acid on blood pressure: a systematic review and metaanalysis of randomized clinical trials, Journal of Human Hypertension, 29, 2014, 77–81.
- Harborne JB, Baxter H, Chemical Dictionary of Economic Plants, JB Harborne and H. Baxter (Eds.); John Wiley & Sons Ltd., Chichester, UK, 2001 pp 217.
- Tierney PA, Karpinski CD, Brown JE, Luo W, Pankow JF, Flavour chemicals in electronic cigarette fluids, Tob Control, 25, 2016, e1: e10-5.
- Klocke JA, Darlington MV, Balandrin MF, 1,8-Cineole (Eucalyptol), a Mosquito Feeding and Ovipositional Repellent from Volatile Oil of Hemizonia fitchii (Asteraceae)", Journal of Chemical Ecology, 13, 1987, 2131-41



Available online at www.globalresearchonline.net

- Sfara V, Fumigant Insecticidal Activity and Repellent Effect of Five Essential Oils and Seven Monoterpenes on First-Instar Nymphs of Rhodnius prolixus", Journal of Medical Entomology, 46, 2009, 511– 5.
- Karl GF, Hammerschmidt FJ, Panten J, Pickenhagen W, Dietmar S, Bauer K, Garbe D, Surburg H, "Flavors and Fragrances" in Ullmann's Encyclopedia of Industrial Chemistry, Wiley-VCH, Weinheim 2002.
- Jadhav BK, Khandelwal KR, Ketkar AR, Pisal SS, Formulation and evaluation of mucoadhesive tablets containing eugenol for the treatment of periodontal diseases, Drug Dev Ind Pharm, 30, 2004, 195–203.
- 57. Jack LF. Materials in Dentistry: Principles and Applications, 2nd ed., Lippincott Williams & Wilkins 2001.
- Gill AO, Holley RA, Mechanisms of Bactericidal Action of Cinnamaldehyde against Listeria monocytogenes and of Eugenol against L. monocytogenes and Lactobacillus sakei", Applied and Environmental Microbiology, 70, 2004; 70, 5750–5.
- 59. Yao YQ, Ding X, Jia YC, Huang CX, Wang YZ, Xu YH, "Anti-tumor effect of β-elemene in glioblastoma cells depends on p38 MAPK activation", Cancer Letters, 264, 2008, 127–34.
- 60. Hausen BM, Schmieder M, The sensitizing capacity of coumarins (I), Contact Dermatitis, 15, 1986, 157–63
- 61. Lang M, Stober F, Lichtenthaler HK, Fluorescence emission spectra of plant leaves and plant constituents", Radiation and Environmental Biophysics, 30, 1991, 333–47.
- 62. Liu XF, Xia YM, Fang Y, Zou L, Liu LL, "Interaction between natural pharmaceutical homologues of coumarin and bovine serum albumin". Huaxue xuebao, 62, 2004, 1484–90.
- Müller-Enoch D, Seidl E & Thomas H, "6-7-Dihydroxycoumarin (Aesculetin) as a substrate for catechol-o-methyltransferase", Z Naturforsch C, 31, 1976, 280–4.
- 64. Thompson DC, Barhoumi R, Burghardt RC, Comparative toxicity of eugenol and its quinone methide metabolite in cultured liver cells using kinetic fluorescence bioassays, Toxicology and applied pharmacology, 149, 1998, 55–63.
- Fujisawa S, Atsumi T, Kadoma Y, Sakagami H, Antioxidant and prooxidant action of eugenol-related compounds and their cytotoxicity, Toxicology, 177, 2001, 39–54.
- Kromidas L, Perrier E, Flanagan J, Rivero R, Bonnet I, Release of antimicrobial actives from microcapsules by the action of axillary bacteria, Int J Cosmet Sci, 28, 2000, 103–08.
- 67. Jacob MH, Quorum sensing in the Dimorphic Fungus Candida albicans is mediated by Farnesol, Appl Environ Microbiol, 67, 2001, 2982–92.
- Satomi H, Umemura K, Ueno A, Hatano T, Okuda T, Noro T, Carbonic anhydrase inhibitors from the pericarps of Punica granatum L, Biological & Pharmaceutical Bulletin, 16, 1993, 787– 90.
- Liu Y, Pukala TL, Musgrave IF, Williams DM, Dehle FC, Carver JA, Gallic acid is the major component of grape seed extract that inhibits amyloid fibril formation, Bioorganic & Medicinal Chemistry Letters, 23, 2013, 6336–40.
- Wang YJ, Thomas P, Zhong JH, Bi FF, Kosaraju S, Pollard A, Fenech M, Zhou XF, Consumption of grape seed extract prevents amyloidbeta deposition and attenuates inflammation in brain of an Alzheimer's disease mouse, Neurotoxicity Research, 15, 2009, 3– 14.
- 71. Liu Y, Carver JA, Calabrese AN, Pukala TL, Gallic acid interacts with α -synuclein to prevent the structural collapse necessary for its aggregation, Biochimica et Biophysica Acta (BBA) Proteins and Proteomics, 1844, 2014, 1481–5.

- Fiuza SM, Gomes C, Teixeira LJ, Girão da Cruz MT, Cordeiro MNDS, Milhazes N, Borges F, Marques MPM, Phenolic acid derivatives with potential anticancer properties a structure activity relationship studies. Part 1: Methyl, propyl, and octyl esters of caffeic and gallic acids", Bioorganic & Medicinal Chemistry. Elsevier, 12, 2004, 3581– 9.
- Wong KC, Ong KS, Lim CL, "Composition of the essential oil of rhizomes of Kaempferia Galanga L", Flavour and Fragrance Journal, 7, 2006, 263–6.
- 74. Bekele DA, Geleta GS, Iodometric Determination of the Ascorbic Acid (Vitamin C) content of some Fruits consumed in Jimma Town Community in Ethiopia, J Chem Sci, 5, 2015, 60-3.
- 75. Lewis RJS, Dangerous Properties of Industrial Materials, 1–3, 9th ed., New York, NY: Van Nostrand Reinhold 1996, p. 2897.
- 76. Sushil KK, Endocrine Disruptors in the Environment, Wiley, 2014 pp. 109.
- Pugazhendhi D, Pope GS, Darbre PD, Oestrogenic activity of phydroxybenzoic acid (common metabolite of paraben esters) and methylparaben in human breast cancer cell lines, J Appl Toxicol, 25, 2005, 301–9.
- Julie G, Holistic Beauty from the Inside Out: Your Complete Guide to Natural Health, Nutrition, and Skincare, Seven Stories Press, 2013, pp. 31.
- Lemini C, Silva G, Timossi C, Luque D, Valverde A, González-Martínez M, Hernández A, Rubio-Póo C, Chávez Lara B, Valenzuela F, Estrogenic effects of p-hydroxybenzoic acid in CD1 mice, Environ Res, 75, 1997, 130–34.
- Sun J, d-Limonene: safety and clinical applications, Alternative Medicine Review, 12, 2007, 259–64.
- Butler P, "It's Like Magic; Removing Self-Adhesive Stamps from Paper, American Philatelist, American Philatelic Society, 124, 2010, 910–3.
- Wynnchuk M, "Evaluation of Xylene Substitutes for A Paraffin Tissue Processing", Journal of Histotechnology, 2, 1994, 143–9.
- Carson F, Histotechnology, A Self-Instructional Text, Chicago: ASCP Press, 1997 pp.28-31.
- 84. Kiernan JA, Histological and Histochemical Methods. 4th ed. Bloxham, UK, 2008 pp.54-57.
- Widely Used Fragrance Ingredients In Shampoos And Conditioners Are Frequent Causes Of Eczema", Medical News Today, March 28, 2009.
- What to look for when you're buying mosquito repellent, South China Morning Post, September 6, 2015, Retrieved December 30, 2015.
- 87. EPA Linalool Summary Document Registration Review: Initial Docket, April 2007
- Peana AT, Aquila SD, Panin F, Serra G, Pippia P, Moretti MDL, Antiinflammatory activity of linalool and linalyl acetate constituents of essential oils, Phytomedicine, 9, 2002, 721-6.
- Ghosh R, Graham H, Rivas P, Tan XJ, Crosby K, Bhaskaran S, Schoolfield J, Banu J, Fernandes G, Yeh IT, Kumar AP, Phellodendron amurense bark extract prevents progression of prostate tumors in transgenic adenocarcinoma of mouse prostate: Potential for prostate cancer management, Anticancer Research, 30, 2010, 857-66.
- James MA, Fu H, Liu Y, Chen D, You M, Dietary administration of berberine or Phellodendron amurense extract inhibits cell cycle progression and lung tumorigenesis, Molecular Carcinogenesis, 50, 2011, 1-7.
- Xu Y, Ventura S, Extracts of bark from the traditional Chinese herb Phellodendron amurense inhibit contractility of the isolated rat prostate gland, Journal of Ethnopharmacology, 127, 2010, 1: 196-9.



Available online at www.globalresearchonline.net

- 92. Russo EB, "Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects", British Journal of Pharmacology, 163, 2010, 1344–64.
- Jeong KK, Kang CS, Lee JK, Kim YR, Han HY, Yun HK, Evaluation of Repellency Effect of Two Natural Aroma Mosquito Repellent Compounds, Citronella and Citronellal, Entomological Research, 35, 2005, 117–20.
- Kazuhiko N, Alzoreky NS, Yoshihashi T, Nguyen HTT, Trakoontivacom G, Chemical Composition and Antifungal Activity of Essential Oil from Cymbopogon nardus (Citronella Grass), JARQ, 37, 2003, 249-52
- Lin HH, Apoptotic effect of 3, 4-dihydroxybenzoic acid on human gastric carcinoma cells involving JNK/p38 MAPK signaling activation, Int J Cancer, 120, 2007, 2306–16.
- Babich H, Sedletcaia, Kenigsberg B, In vitro cytotoxicity of protocatechuic acid to cultured human cells from oral tissue: involvement in oxidative stress", Pharmacol Toxicol, 91, 2002, 245– 53.
- Liu CL, Wang JM, Chu CY, Cheng MT, Tseng TH, In vivo protective effect of protocatechuic acid on tert-butyl hydroperoxide-induced rat hepatotoxicity", Food Chem Toxicol, 40, 2002, 635–41.
- Pietta PG, Simonetti P, Gardana C, Brusamolino A, Morazzoni P, Bombardelli E, "Catechin metabolites after intake of green tea infusions", BioFactors, 8, 1998, 111–8.
- Srivastava, JK, Gupta S, Antiproliferative and apoptotic effects of chamomile extract in various human cancer cells, Pharmaceutical Research, 55, 2007, 9470–8.
- Sundararaman P, Djerassi C, "A convenient synthesis of progesterone from stigmasterol", J Org Chem, 42, 1977, 3633–4.
- 101. Kametani T, Furuyama H, Synthesis of vitamin D3 and related compounds, Med Res Rev, 7, 1987, 147–171.
- 102. Hogg JA, Steroids, the steroid community, and Upjohn in perspective: A profile of innovation, Steroids, 57, 1992, 593–16.
- 103. Soy I, History of Soybean and Soyfoods in Mexico and Central America (1877-2009).
- Panda S, Jafri M, Kar A, Meheta BK, Thyroid inhibitory, antiperoxidative and hypoglycemic effects of stigmasterol isolated from Butea monosperma, Fitoterapia, 80, 2009, 123–6.
- Gallina G, Ferretti G, Merlanti R, Civitareale C, Capolongo F, Draisci R, Montesissa C, Boldenone, Boldione, and Milk Replacers in the Diet of Veal Calves: The Effects of Phytosterol Content on the Urinary Excretion of Boldenone Metabolites", J Agric Food Chem, 55, 2007, 8275–83.
- Ros MM, Sterk SS, Verhagen H, Stalenhoef AF, de Jong N, Phytosterol consumption and the anabolic steroid boldenone in humans: a hypothesis piloted", Food Addit Contam, 24, 2007, 679–84.
- Draisci R, Merlanti R, Ferretti G, Fantozzi L, Ferranti C, Capolongo F, Segato S, Montesissa C, Excretion profile of boldenone in urine of veal calves fed two different milk replacers", Analytica Chimica Acta, 586, 2007, 171–76.
- 108. Bates RB, Slagel RC, Terpenoids VI, β -Bulnesene, α -guaiene, β -patchoulene, and guaioxide in essential oils, Chemistry & Industry, 1962, 1715–16.
- 109. Shan-Shan Y, Wen-Fei G, Yi L, Yuan-Xun J, Flavor Characteristics of Lapsang Souchong and Smoked Lapsang Souchong, a Special Chinese Black Tea with Pine Smoking Process, Journal of Agricultural and Food Chemistry, 53, 2005, 8688–93.
- Pathak AK, Bhutani M, Nair AS, Ahn KS, Chakraborty A, Kadara H, Guha S, Sethi G, Aggarwal BB, Ursolic acid inhibits STAT3 activation pathway leading to suppression of proliferation and

chemosensitization of human multiple myeloma cells", Mol Cancer Res, 5, 2007, 943–55.

- Lu J, Zheng YL, Wu DM, Luo L, Sun D, Shan Q, Ursolic acid ameliorates cognition deficits and attenuates oxidative damage in the brain of senescent mice induced by D-galactose, Biochemical Pharmacology, 74, 2007, 1078–90.
- 112. Li S, Liao X, Meng F, Wang Y, Sun Z, Guo F, Li X, Meng M & Li Y, Therapeutic role of ursolic acid on ameliorating hepatic steatosis and improving metabolic disorders in high-fat dietinduced non-alcoholic fatty liver disease rats", PloS One, 9, 2014, e86724.
- Jin YR, Jin JL, Li CH, Piao XX, Jin NG, Ursolic acid enhances mouse liver regeneration after partial hepatectomy", Pharmaceutical Biology, 50, 2012, 523–8.
- 114. Jang SM, Yee ST, Choi J, Choi MS, Do GM, Jeon SM, Yeo J, Kim MJ, Seo K-II, Ursolic acid enhances the cellular immune system and pancreatic beta-cell function in streptozotocin-induced diabetic mice fed a high-fat diet, International Immunopharmacology, 9, 2009, 113–9.
- Jeong JW, Shim JJ, Choi, ID, Kim SH, Ra J, Ku HK, Lee DE, Kim TY, Jeung W, Apple Pomace Extract Improves Endurance in Exercise Performance by Increasing Strength and Weight of Skeletal Muscle", Journal of Medicinal Food, 18, 2015, 1380–6.
- Ma CM, Cai SQ, Cui JR, Wang RQ, Tu PF, Hattori M, Daneshtalab M, The cytotoxic activity of ursolic acid derivatives", Eur J Med Chem, 40, 2005, 582–9.
- Pietta P G, Simonetti P, Gardana C, Brusamolino A, Morazzoni P, Bombardelli E, Catechin metabolites after intake of green tea infusions", BioFactors, 8, 1998, 111–18.
- Gálvez MC, Barroso CG, Pérez B, Juan A, Analysis of polyphenolic compounds of different vinegar sample, Zeitschrift für Lebensmittel-Untersuchung und –Forschung, 199, 1994, 29-31.
- 119. Kvasnicka E & Kratzl K. U.S. Patent 2,641,612 (1952 to Chemie Linz Ag),1953
- 120. Gaitan E, "Goitrogens in food and water", Annual Review of Nutrition, 10, 1990, 21–39.
- 121. Birzer DM, Klopfenstein CF, Leipold HW, Goitre causing compounds found in pearl millet, Nutr Rep Int, 36, 1987, 131.
- He M, Min JW, Kong WL, He XH, Li JX, Peng BW, A review on the pharmacological effects of vitexin and isovitexin, Fitoterapia,115, 2016, 74–85.
- Singh S, Rehan HM, Majumdar DK, Effects of Ocimum sanctum fixed oil on blood pressure, blood clotting time and pentobarbitone induced sleeping time, J Ethnopharmacol, 78, 2001, 139-43.
- 124. Singh N, Hoette Y, Miller R, Tulsi: the mother medicines of Nature, International Institute of Herbal medicine Lucknow, 2002.
- 125. Yates B, Holy basil: An overview of the Research & Clinical indication, 1-8.
- Nagarajun S, Jain HC, Aulakh GS Indigenous plant used in infertility control, In cultivation & utilization of medicinal plant, PID CSIR 1989, p-558
- 127. Aruna K, Sivaramakrishnan VM, Anticarcinogenic effects of some Indian plant product, Food Chem Toxicol, 30, 1992, 953-6.
- Serrame E, Lim-Sylianco CY, Anti-tumor promoting activity of decoctions and expressed juices Phillipine Medicinal plants, Phillipine J Sci, 124, 1995, 275-81.
- Benergee S, Prashar R, Kumar A, Rao AR, Modulatory influence of alcoholic extractof osmium on carcinogenic metabolizing enzyme activities and reduced glutathione level in mouse, Nutr Cancer, 25, 1996, 205-17.



Available online at www.globalresearchonline.net

- Manikandan P, Murugan RS, Abbas H, Abraham SK, Nagini S, Ocimum sanctum Linn. (Holy Basil) ethanolic leaf extract protects against 7, 12-dimethylbenz (a) anthracene-induced genotoxicity, oxidative stress, and imbalance in xenobiotic-metabolizing enzymes, J Med Food, 10, 2007, 495–02.
- 131. Manikandan P, Vidjaya Letchoumy P, Prathiba D, Nagini S, Combinatorial chemopreventive effect of Azadirachta indica and Ocimum sanctum on oxidant-antioxidant status, cell proliferation, apoptosis and angiogenesis in a rat forestomach carcinogenesis model, Singapore Med J, 49, 2008, 814–22.
- 132. Singh V, Ocimum sanctum (Tulsi): Biopharmacological activities, Web Med Central.
- 133. Khan MRI, Islam MA, Hossain MS, Wahed MII, Antidiabetic effects of different of ethanoic extract of Osimum sanctum in normal and alloxan induced diabetic rats, J Sci Res, 2,2010, 158-68.
- Hakkim FL, Shankar CG, Girija S, Chemical composition and antioxidant property of holy basil (Ocimum sanctum L.) leaves stems, and inflorescence and their in vitro callus cultures, J Agric Food Chem, 55, 2007, 9109-17.
- 135. Wagner H, Norr H, Winterhoff H. Plant Adeptogens, Phytomedicine, 1, 1994, 63-76.
- 136. Hannan JM, Marenah L, Ali R, Rokeya B, Flatt PR, Abdel-Wahab YH, Ocimum sanctum leaf extract stimulate insulin secretion from perfused pancreas, isolated islets and clonal pancreatic betacells, J Endocrinol, 189, 2006, 127-36.
- 137. Sharma M, Kamal K, Suresh KG, Sujata J, Dharamvir SA, Cardioprotective potential of Ocimum sanctum in isoproterenol induced myocardial infarction in rats Molecular and Cellular Biochemistry, 225, 2001, 75–83.
- Sood S, Narang D, Dinda AK, Maulik SK, Chronic Oral administration of Ocimum sanctum Linn. Auguments cardiac endogenous antioxidants and prevents isoproterenol induced myocardial necrosisi in rats, J Pharma Pharmacolo, 57, 2005, 127-33.
- 139. Balaneharu S, Nagarjan B, Intervention of adriycin induced free radical damage. Biochem Int, 28, 1992, 735-44.
- 140. Rehman, MS, Khan MMH, Jamal MAHM, Antibacterial evaluation and minimum inhibitory concentration analysis of Oxalis corniculata and Ocimum sanctum against bacterial pathogens, Biotechnology, 9, 2010, 533-6.
- 141. Mishra P, Mishra S, Study of bacterial activity of Ocimum sanctum extract against gram positive and gram negative bacteria, Am J food Technol, 6, 2011, 336-41.
- 142. Mondal S, Mirdha BR, Mahapatra SC, The science behind sacredness of Tulsi (Ocimum sanctum), Ind Physiol Pharmacol,53, 2009, 291-206.
- 143. Mondal S, Mirdha BR, Mahapatra SC, Antimicrobial activity of Ocimum sanctum L. fixed oil, Ind J Exp Biol, 43, 2005, 835-7.
- Shokeen P, Ray K, Bala M, Tondon V, Prelimnary studies on activity of Ocimum sanctum, Drynaria quercifolia and Annona squamosa against Neisseria gonorrhoeae, Sex Transm Dis, 32, 2005, 106-11.
- 145. Asha MK, Prashanth D, Murli B, Padmaja R, Amit A, Antihelmintic activity of essential oil of Ocimum sanctum and eugenol, Fitoterapia, 72, 2001, 669-70.

- 146. Vinayagam A, Senthelkumar N, Umamahesawari A, Larval activity of some medicinal plant extract against malaria vector anopheles stephensi, Res J Parasitol, 3, 2008, 50-8.
- 147. Ganasoundari A, Devi PU, Rao MN, Protection against radiation induced chromosome damage in mouse bone marrow by Ocimum sanctum, Mutation Res, 373, 1997, 271-6.
- 148. Ganasooundari A, Zare SM, Devi UP, Modification of normal tissue sensitivity by some meditional plant, Br J Radiol, 70, 1997, 599-602.
- 149. Subramanian M, Chintalwar GJ, Chattopadhyay S, Antioxidant and radioprotective properties of an Ocimum sanctum polysaccharide, Redox Rep, 10, 2005, 257-64.
- 150. Shetty SS, Udupa S, Udupa L, Evaluation of antioxidant and wound healing effects of alcoholic and aqueous extract of sanctum Linn. in rats evids based complement, Alternat Med, 5, 2008, 95-101.
- 151. Goel A, Singh DK, Kumar S, Bhatia AK, Wound healing potential of Ocimum sanctum Linn. with induction of tumor necrosis α , Indian J Exp Bio, 48, 2010, 402-6.
- Sridevi G, Gopkumar P, Ashok S, Shastry GS, Pharmacological basis for antianaphylactic, antihistaminic and mast cell stabilization activity of Ocimum sanctum, Internet J, Pharmacol, 7, 2009.
- Babu K, Mahesawari URC, In vitro studies on effects of Ocimum sanctum L. leaf extract in modifying the genotoxicity induced by chromium and mercury in Allium root meristems, J Environ Biol, 27, 2006, 93-5.
- Siddique HH, Ara G, Beg T, Afzal M, Antigenotoxic effect of Ocimum sanctum L. exreact against cyproteronacetate inducedgenotoxic damage in cultured mammalian cells, Acta Boil Hungerica, 58, 2007, 397-09.
- 155. Maity T K, Mandal S C, Saha B P, Pal M, Effect of Ocimum sanctum roots extract on swimming performance in mice, Phytother Res, 14, 2000, 120-1.
- Nadig PD, Laxmi S, Study of anti-tussive activity of Ocimum sanctum Linn. in guinea pigs, Indian J Physiol Pharmacol, 49, 2005, 243-5.
- 157. Joshi H, Parle M, Evaluation of noortropic potential of Ocimum sanctum Linn. in mice, Indian J Exp Biol, 44, 2006, 133-6.
- 158. Kelm MA, Nair MG, Strasburg GM, De Witt DL, Antioxidant and cyclooxygenase inhibitory phenolic compounds from Ocimum sanctum Linn, Phytomedicine, 7, 2000, 7-13.
- 159. Moinuddin G, Devi K, Satish H, Khajuria DK, Comperative pharmacological evaluation of Ocimum sanctum and imipramine for antidepressant activity, Lat Am J Pharm, 30, 2011, 435-9.
- Giridharan VV, Thandavarayan RA, Mani V, Dundapa AT, Watanbe K, Konishi T, Ocimum sanctum Linn. leaf extracts inhibit acetylcholinesterase and improve cognition in rats with experimentally inducerd dementia, J Med Food, 14, 2011, 912-9.
- Bhattacharyya D, Sur TK, Jana U, Debnath PK, Contolled programmed trail of Ocimum sanctum leaf on generalized anxiety disorders, Nepal Med Coll J, 10, 2008, 176-9.

Source of Support: Nil, Conflict of Interest: None.



International Journal of Pharmaceutical Sciences Review and Research

Available online at www.globalresearchonline.net