

## OCIMUM SANCTUM: NATURAL'S VERSATILE HERB UNVEILED

Nidhi Singh\*<sup>1</sup>, Tanya Jain\*<sup>2</sup>, Roshan San\*<sup>3</sup>, Dr. Shobhit Prakash Srivastava\*<sup>4</sup>

\*<sup>1,2,3,4</sup>Dr. M.C. Saxena College Of Pharmacy, India.

DOI : <https://www.doi.org/10.56726/IRJMETS52038>

### ABSTRACT

Explore the depth of Ocimum sanctum in this thorough review, meticulously analyzing its richness. This article critically evaluates existing literature, illuminating the herb's multifaceted aspects, spanning from historical significance to modern applications. Synthesizing diverse perspectives, the review not only reveals the herb's holistic benefits but also provides a roadmap for future research, establishing itself as an indispensable resource for scholars and enthusiasts.

**Keywords:** Versatile Herb, Diverse Perspective, Tulsi.

### I. INTRODUCTION

Despite the numerous prodigies of wisdom and assiduity, ultramodern life is fraught with stress. Mobile bias and the web have extensively increased the pace of life so that numerous people feel that they're now drowning in an ever-expanding ocean of data, while artificial husbandry has burdened us with adding exposure to unhealthy reused and packaged food and a plethora of fungicides, food packaging accoutrements and other poisonous artificial chemicals. Civic residents are also faced with adding wealth inequality, social insulation, inordinate noise, air, water and soil pollution and disposition from nature. Therefore, while industrialization has led to longer dates and vast increases in mortal populations, it's now honored that the topmost causes of death and complaint on the earth are preventable life-related habitual conditions. (1)

We're in the midst of a global epidemic of rotundity, diabetes, cancer, madness, depression and other habitual conditions caused by ultramodern cultures and their associated lack of physical exertion, high input of sugar, fat, swab, alcohol and tobacco and exposure to a poisonous blend of artificial chemicals. The results to this current health extremity are thus more likely to be set up in the homes and actions of individualities than in medical conventions, sanitarium or apothecaries.

#### A. Ayurveda and lifestyle medicine

As wisdom of life and the world's oldest medical system, Ayurveda has a holistic approach to health and complaint that focuses on conserving and promoting good health and precluding complaint through healthy life practices. These practices include consumption of fresh, minimally reused foods, the use of Ramayana's (formulas) that annihilate geriatric and complaint, sophisticated detoxification practices and regular consumption of adaptogenic sauces that enhance the body's capacity to maintain balance in the midst of a variety of stressors.

Ayurveda's use of medicinal and culinary sauces draws upon India's inconceivable biodiversity with a variety that's unequalled by any medical system; yet, of all the sauces used, none has a status similar to tulsi or holy basil (Ocimum sanctum).

#### B. Tulsi

Tulsi is a fragrant bush in the basil family Lamiaceae (clan ocimeae) that is remembered to have started in north focal India and presently develops local all through the eastern world tropics.[2] Inside Ayurveda, tulsi is known as "The Exceptional One," "Mother Medication of Nature" and "The Sovereign of Spices," and is venerated as an "mixture of life" that is truly incredible for the two its restorative and profound properties.[3] Inside India, tulsi has been taken on into otherworldly customs and way of life rehearses that give an immense range of medical advantages that are simply starting to be affirmed by current science. This arising science on tulsi, which supports old Ayurvedic intelligence, proposes that tulsi is a tonic for the body, brain and soul that offers answers for some current medical conditions.

Tulsi is maybe one of the most outstanding instances of Ayurveda's all-encompassing way of life way to deal with wellbeing. Tulsi tastes hot and severe and is said to infiltrate the profound tissues, dry tissue discharges and standardize kapha and vata. Everyday utilization of tulsi is said to forestall illness, advance general

wellbeing, prosperity and life span and help with managing the anxieties of day-to-day existence. Additionally, tulsi is recommended as a treatment for a variety of conditions, including anxiety, cough, asthma, diarrhea, fever, dysentery, arthritis, eye diseases, otalgia, indigestion, hiccups, vomiting, gastric, cardiac, and genitourinary disorders, back pain, skin diseases, ringworm, insect, snake, and scorpion bites, and malaria. [3,4,5,6] In addition to these health-promoting properties, tulsi.

Considered as a powerful adaptogen, tulsi has an extraordinary blend of pharmacological activities that advance prosperity and strength. Western science has demonstrated that tulsi does indeed possess many pharmacological actions that fulfill this purpose, despite the fact that the term "adaptogen," which refers to an herb that aids in the adaptation to stress and the promotion of homeostasis, is not widely used in Western medicine.

The restorative properties of tulsi have been concentrated on in many logical examinations remembering for vitro, creature and human tests. These investigations uncover that tulsi has a special blend of activities that include: Antimicrobial (counting antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, anthelmintic), mosquito repellent, hostile to diarrheal, against oxidant, hostile to waterfall, calming, chemo preventive, radio protective, hepato-defensive, neuro-defensive, cardio-defensive, against diabetic, hostile to hypercholesterolemia, hostile to hypertensive, hostile to cancer-causing, pain relieving, hostile to pyretic, against hypersensitive, immunomodulatory, focal sensory system depressant, memory upgrade, hostile to asthmatic, hostile to tussive, diaphoretic, hostile to thyroid, against fruitfulness, against ulcer, against emetic, hostile to convulsive, hostile to ligament, adaptogenic, against stress, against waterfall, hostile to leukodermal and against coagulant activities.[4,5,6,7] These pharmacological activities assist the body and brain with adapting to a large number of substance, physical, irresistible and profound burdens and reestablish physiological and mental capability.

### C. Protection and detoxification

A considerable lot of the physiological advantages of tulsi can be credited to its capacity to help with the body's inner housekeeping and insurance of the body from poison initiated harm. Krishna tulsi, a black/purple variety, has a higher phenolic content and anti-oxidant capacity than white Vana tulsi, a wild variety.[8] These functions are frequently attributed to tulsi's high content of phenolic compounds and anti-oxidant properties.

Research facility studies have shown that tulsi safeguards against poisonous substance prompted injury by expanding the body's degrees of hostile to oxidant atoms, for example, glutathione and improving the movement of hostile to oxidant proteins, for example, superoxide dismutase and catalase, which safeguard cell organelles and films by wiping up harming free revolutionaries brought about by absence of oxygen[9] and other harmful agents.[10,11]

Tulsi likewise assists with forestalling diseases brought about by harmful mixtures by decreasing DNA damage[12] and actuating apoptosis in precancerous and dangerous cells, accordingly diminishing the development of exploratory cancers and improving survival.[13,14] Besides, tulsi not just safeguards against the harm brought about by poisonous mixtures, yet additionally empowers the body to all the more successfully change and kill them by upgrading the action of liver detoxification compounds, for example, the cytochrome P450 proteins, which deactivates poisonous synthetics and empowers them to be securely excreted[15]

While these activities are essentially significant for safeguarding against regular poisons delivered inside the body or by creatures or plants, they are maybe much more significant in the cutting edge age to safeguard against the tremendous scope of contaminations, pesticides, drugs, weighty metals, radiation and other modern poisons made from human action.

### D. Toxicant stress: Chemicals, heavy metals and radiation

The capacity of tulsi to safeguard against the harming impacts of different poisons has been recorded in various exploratory examinations. These investigations bear witness to the capacity of tulsi to forestall liver, kidney and mind injury by safeguarding against the hereditary, insusceptible and cell harm brought about by pesticides, drugs and modern synthetic substances. In this way, tulsi has been displayed to safeguard against the poisonous impacts of modern synthetic compounds, for example, butylparaben,[16] carbon tetrachloride,[17]

copper sulfate[18] and ethanol,[19] and normal pesticides, for example, rogor,[20] chlorpyrifos,[21] endosulfan[22] and lindane.[23] Tulsi has likewise been displayed to safeguard against the harmful impacts of numerous drugs including acetaminophen,[24] meloxicam,[25] paracetamol,[26] haloperidol[27] and hostile to tubercular drugs.[28]

As well as safeguarding against poisonous synthetic compounds, tulsi has additionally been displayed to safeguard against the harmful impacts of weighty metals like lead, arsenic, cadmium, chromium and mercury[29,30,31] and the harmful impacts of radiation.[32,33,34,35] Tulsi applies its radio-defensive impacts by rummaging free revolutionaries and diminishing the oxidative cell and chromosomal harm prompted by radiation,[33,36,37,38] consequently lessening organ harm and upgrading post radiation endurance in exploratory animals.[39,40,41]

#### E. Physical stress

In addition to protecting against the harmful effects of radiation and chemicals, protecting against the harmful effects of many physical stressors is aided by the same measures. Delayed actual effort, actual restriction, openness to cold and exorbitant commotion upset homeostasis by instigating physiological and metabolic pressure. At the point when the ability to adjust to these stressors is surpassed, maladaptation happens bringing about harm to biochemical pathways, organ capability and wellbeing. Adaptogenic herbs like tulsi are able to protect against this damage by enhancing a variety of cellular and physiological adaptive functions.

Concentrates on utilizing constrained swimming, restriction and cold-openness stress in lab creatures have shown that tulsi upgrades vigorous digestion, works on swimming time, decreases oxidative tissue harm and standardizes numerous physiological and biochemical boundaries brought about by actual stressors. Essentially, exploratory examinations have shown that tulsi diminishes the impacts of intense and ongoing commotion prompted pressure in trial creatures, with upgrade of synapse and oxidative feelings of anxiety in discrete cerebrum areas alongside worked on resistant, ECG and corticosteroid responses.[42,43,44,45]

#### F. Metabolic stress

The so-called "metabolic syndrome" is thought to affect as much as one third of modern populations. Metabolic stress is caused by poor diet, inactivity, and psychological stress. Metabolic disorder, otherwise called "prediabetes" or "Condition X," incorporates the "lethal group of four" of centripetal weight, hypertension, elevated cholesterol and unfortunate glucose guideline and is related with constant irritation and a more serious gamble of diabetes, coronary illness and stroke. Even though the exact causes of metabolic syndrome are still up for debate, there is evidence that tulsi can help deal with many of its symptoms and the negative effects they cause.

Various test cylinder and creature tests as well as human clinical preliminaries have shown that tulsi has against diabetic action. Concentrates on utilizing diabetic research center creatures have shown that tulsi can diminish blood glucose, right unusual lipid profiles[46,47] and shield the liver and kidneys from the metabolic harm brought about by high glucose levels.[48] Tulsi has likewise been displayed to further develop lipid profiles,[49,50] forestall weight gain, hyperglycemia, hyperinsulinemia, hypertriglyceridemia and insulin resistance,[51,52] and safeguard the organs and veins from atherosclerosis[49,53] in lab creatures took care of high-fat eating regimens. Also, in human clinical preliminaries, tulsi has displayed to diminish glucose levels, further develop pulse and lipid profiles [54,55,56] and lessen numerous diabetic side effects in patients with type 2 diabetes.[57]

The advantageous metabolic impacts of tulsi are numerous and incorporate safeguarding the liver, kidneys[49] and pancreatic islet cells from free revolutionary damage;[58] upgrading liver bile corrosive synthesis[49] and lessening liver lipid synthesis;[52] improving insulin secretion[59] and action;[60] bringing down cortisol levels;[61] and decreasing irritation. The mitigating activity of tulsi, which has been seen in both intense and persistent provocative models in animals,[62,63,64,65] is credited to tulsi's eugenol and linoleic corrosive substance and the restraint of both the cyclooxygenase and the lipoxygenase pathways of arachidonic corrosive metabolism.[66,67] This empowers tulsi to apply calming impacts practically identical to nonsteroidal calming medications, for example, phenylbutazone,[68] ibuprofen, naproxen, aspirin[69] and indomethacin.[70]

### G. Infection protection

Current examination has uncovered that tulsi has hostile to bacterial, hostile to viral and against contagious activity [71] that incorporates action against numerous microorganisms liable for human contaminations. Tulsi has additionally been displayed to support guards against infective dangers by improving safe reactions in no stressed and focused animals[72,73,74,75,76,77] and solid humans.[78] While no human preliminaries have been distributed, there is exploratory proof that tulsi may help in the treatment of different human bacterial contaminations including urinary parcel infections,[79] skin and wound infections,[80] typhoid fever,[81] cholera,[82] tuberculosis,[83] gonorrhoea,[84] acne,[85] herpes simplex,[86] leishmaniasis,[87] different pneumonias[88] and contagious infections,[89,90,91,92] as well as mosquito-borne sicknesses like dengue, intestinal sickness and filariasis.[93,94,95]

Tulsi has likewise been demonstrated to be dynamic against numerous creature microbes, and this has prompted tulsi being utilized in creature raising to diminish contaminations in cows,[96] poultry,[97] goats,[98] fish[76,77] and silkworms.[99] Tulsi's movement against water-borne and food-borne microorganisms further recommends that it tends to be utilized in the protection of food stuffs[100,101,102] and home grown crude materials[103] as well concerning water purification[82] and as a hand sanitizer.[104]

Tulsi's expansive range action, which incorporates movement against *Streptococcus mutans*, the creature liable for tooth rot, further recommends that it very well may be utilized as a natural mouth wash for treating terrible breath, gum sickness and mouth ulcers.[105,106] This has been affirmed in clinical preliminaries that have exhibited that flushing with tulsi is pretty much as compelling as 0.2% Chlorhexidine and Listerine in decreasing the degrees of *Streptococcus mutans*[107] and that a home grown mouthwash that incorporates tulsi is liked for its taste and convenience[108]

Tulsi's exceptional mix of antibacterial cell reinforcement, calming and pain relieving exercises additionally makes it valuable in injury healing.[109,110] This is upheld by exploratory proof that has shown that tulsi can increment wound-breaking strength and speed up injury mending in research center animals.[110,111] Tulsi has likewise been displayed to have against ulcer and ulcer-recuperating action that has been seen in a wide range of creature models including ibuprofen, indomethacin-, liquor, receptor, reserpine-, serotonin-, acidic corrosive, meloxicam-, cold limitation, pyloric ligation- and stress-prompted ulceration models.[112,113,114] This enemy of ulcer movement is credited to numerous activities including the decrease of hostile factors, for example, corrosive pepsin emission and lipid peroxidation and the improvement of gastric protective factors, for example, mucin discharge, cell bodily fluid and life span of mucosal cells.[114,115]

### H. Mental stress

Notwithstanding physical, poisonous and infective pressure, present day living is related with elevated degrees of mental pressure brought about by the many requests and high speed of current life. This pressure intensifies the harmful impacts of substance poisons and the steady apprehension about inescapable poisonous synthetic compounds could itself at any point lead to much further pressure and tension that might be similarly all around as harmful as the synthetics causing it. While the truth of day to day substance openness can't be denied, normal utilization of tulsi not just secures and detoxify the body's phones and organs, it can likewise assist with lessening poisonous pressure by unwinding and quieting the brain and offering numerous mental advantages remembering stimulant movement and constructive outcomes for memory and mental capability.

In animal studies, tulsi has been shown to have anti-anxiety and anti-depressant properties, with effects comparable to those of diazepam and antidepressants [116,117,118]. Animal studies also show that tulsi improves memory and cognitive function [121,122] and protects against aging-induced memory deficits. In human studies, tulsi has been shown to reduce stress, anxiety, and depression. A 6-week, randomized, double-blind,

In Ayurveda, tulsi is more frequently recommended as a preventive measure to improve one's capacity to adapt to both psychological and physical stress and, as a result, prevent the development of stress-related diseases. Modern scientific studies indicate that tulsi is effective in treating a variety of stressful conditions. To this end,

numerous Ayurvedic specialists suggest the ordinary utilization of tulsi tea as a fundamental way of life practice.

### **I. Liquid yoga**

Tulsi tea can be compared to regular yoga practice, which is considered "adaptogenic" because it promotes a sense of relaxation and well-being while also nourishing the body, mind, and spirit. Conversely, ordinary utilization of charged drinks such as a dark and green tea (*Camellia sinensis* L.) and espresso (*Coffea arabica* L.) might be contrasted and more high-impact work out, which gives medical advantages through feeling and enactment.

Like yoga, tulsi has a quieting impact that prompts unwavering focus, alongside a more loose and quiet demeanor. The mental and memory-upgrading properties of tulsi in this way vary from those of caffeine-containing drinks, for example, espresso and tea, which elevates excitement and may cause physical and mental fomentation. Additionally, tulsi does not result in the same level of physical dependence as caffeine, so it is safe to consume on a regular basis without having to worry about the withdrawal effects of caffeine.

The drinking of tea and espresso has turned into a vital piece of present day life and has been ritualized in many societies to direct friendly cooperations, set social plans and summon profound mindfulness. For instance, refined Asian tea functions include an entire arrangement of ceremonies, devices and motions that rise above typical cognizance, while in the west the custom of "evening tea" or "high tea" stresses the environmental elements, hardware, habits and group of friends. In less-formal circumstances, many individuals ritualize their morning mug of espresso and utilize the "get together for espresso" to orchestrate their social plans, while the "lunch break" is frequently incorporated into the current work schedule. However, while tea and espresso have penetrated their direction into present day living, they have not yet accomplished the status that tulsi has inside customary Indian life.

### **J. Divine tulsi**

In Hinduism, tulsi is venerated as a goddess and all aspects of the tulsi plant is worshipped and considered hallowed, including the leaves, stem, blossom, root, seeds and oil. It has recently been discovered that the surrounding soil, which is thought to contain beneficial endophytic fungi[126], is regarded as an aspect of the divine. Thusly, Hindi families are thought of as deficient without a tulsi plant, commonly in a lavish earthen pot arranged in a yard where tulsi fills both reasonable and stately needs. For instance, tulsi's unmistakable clove-like smell emerging from its high eugenol content connections the householder to the heavenly while additionally repulsing mosquitoes, flies and other destructive bugs. Evening and morning rituals, as well as other spiritual and purification practices that may include drinking tulsi tea or inhaling its leaves, further integrate tulsi into daily life.

In Hinduism and some Greek Orthodox churches, tulsi is used ceremonially to create "holy water" in addition to sanctifying the home. Tulsi wood or seeds are additionally used to make tulsi malas, which are series of dots used to assist the brain with centering during contemplation, reciting and reflection rehearses and consequently formally interface psyche, body and soul. Tulsi has likewise been utilized in urban areas to battle air contamination and a huge number of tulsi plants have been planted around the Taj Mahal in Agra to assist with safeguarding the notorious marble working from ecological contamination damage.[127]

### **K. Nature nurture**

The development and worship for the tulsi plant in the home not just fills explicit strict needs it additionally straightforwardly associates the lover with the imaginative force of nature. Association with nature is significantly recuperating and invigorating; however, the likely wellbeing, close to home, social and mental advantages of association with nature is just barely being acknowledged in the west where detachment from nature and "nature shortage" are normal. "Access to nature plays a vital role in human health, wellbeing, and development that has not been fully recognized," according to a review of the scientific literature on the health benefits of connection to nature [128]. There is currently a global movement to reconnect people with nature as a result of concerns over nature deficiency, sedentary lifestyles, obesity, mental health issues, and excessive use of electronic media, environmental degradation, wildlife conservation, sustainability, and climate change [129].

As a result, the practice of putting a living tulsi plant at the center of the home can be used outside of Hinduism to address contemporary issues because it embodies the healing power of nature and serves as a constant connection to living nature.

#### L. Quality assurance and identification

To preserve the medicinal value of tulsi, as with any other medicinal plant, the best practices for cultivation, harvesting, preservation, and storage are required. For instance, toxic elements were found to be nearly twice as high in tulsi leaves grown in polluted areas as they were in unpolluted ones, indicating that organic tulsi cultivation should be encouraged in environmentally clean rural areas[3]

It is likewise vital to guarantee the right spice is utilized and that makers embrace rigid quality affirmation norms and cycles. Reports of a high frequency of substitution with surrogate herbs like *Ocimum basilicum* L have raised concerns about the quality of European "tulsi" products.[131] This can be addressed by using high-performance liquid chromatography fingerprints and microscopic assays to ensure the safety and botanical integrity of standardized extracts of standardized extracts from batch to batch. [131,132]

#### M. Tulsi as a vehicle of consciousness

Maybe one of the best of tulsi's advantages in the cutting edge world comes from its worldwide conveyance in light of its development utilizing moral, fair exchange, natural and biological cultivating rehearses. There is a developing acknowledgment that to handle issues of food security, country neediness, hunger, natural corruption and environmental change a change in horticulture is required from a "green upset" to a "biological strengthening upheaval. This has been featured in a new Joined Countries report named "Wake Up Before It's Past the point of no return," which requires the worldwide local area to embrace and promoter for nearby answers for harmfulness, food frailty and destitution, like the utilization of natural and limited scope cultivating over the utilization of hereditarily changed organic entities and monocultures.[133] While environmental cultivating strategies are not well defined for tulsi, they have been successfully applied to tulsi development by Natural India Pvt. Ltd. This organization, which was laid out as a "vehicle of cognizance," works with large number of natural tulsi ranchers in India to create a business environment by which provincial Indian ranchers gain their nobility and a solid and practical job while effectively supporting the land they live on and produce a scope of teas that empower buyers all over the planet to get to the advantages of tulsi.

## II. CONCLUSION

Today's scientific studies on tulsi bear witness to the wisdom found in Ayurveda and Hinduism, which revere tulsi as a plant that can be consumed, consumed raw, made into tea, and used for both medicinal and spiritual purposes in daily life. These studies also show the numerous psychological and physiological benefits of tulsi consumption. Tulsi horticulture addresses more than just individual and household benefits; it also starts to address larger social, economic, and environmental challenges by serving as a focal point for ethical, sustainable, and ecological farming practices that support thousands of farmers.

## III. REFERENCES

- [1] World Health Organisation. Preventing Chronic Diseases: A Vital Investment: WHO Global Report. Geneva: World Health Organization; 2005. Department of Chronic Diseases and Health Promotion; p. 18. [Google Scholar]
- [2] Bast F, Rani P, Meena D. Chloroplast DNA phylogeography of holy basil (*Ocimum tenuiflorum*) in Indian subcontinent. *ScientificWorldJournal*. 2014;2014:847-482. [PMC free article] [PubMed] [Google Scholar]
- [3] Singh N, Hoette Y, Miller R. Tulsi: The Mother Medicine of Nature. 2nd ed. Lucknow: International Institute of Herbal Medicine; 2010. pp. 28-47. [Google Scholar]
- [4] Mahajan N, Rawal S, Verma M, Poddar M, Alok S. A phytopharmacological overview on *Ocimum* species with special emphasis on *Ocimum sanctum*. *Biomed Prev Nutr*. 2013;3:185-92. [Google Scholar]
- [5] Mohan L, Amberkar MV, Kumari M. *Ocimum sanctum* linn. (TULSI)-an overview. *Int J Pharm Sci Rev Res*. 2011;7:51-3. [Google Scholar]

- [6] Pattanayak P, Behera P, Das D, Panda SK. *Ocimum sanctum* Linn. A reservoir plant for therapeutic applications: An overview. *Pharmacogn Rev.* 2010;4:95–105. [PMC free article] [PubMed] [Google Scholar]
- [7] Mondal S, Mirdha BR, Mahapatra SC. The science behind sacredness of Tulsi (*Ocimum sanctum* Linn.) *Indian J Physiol Pharmacol.* 2009;53:291–306. [PubMed] [Google Scholar]
- [8] Wangcharoen W, Morasuk W. Antioxidant capacity and phenolic content of holy basil. *Songklanakarin J Sci Technol.* 2007;29:1407–15. [Google Scholar]
- [9] Panda VS, Naik SR. Evaluation of cardioprotective activity of *Ginkgo biloba* and *Ocimum sanctum* in rodents. *Altern Med Rev.* 2009;14:161–71. [PubMed] [Google Scholar]
- [10] 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.* 2012;18:331–48. [Google Scholar]
- [11] 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.* 2007;10:495–502. [PubMed] [Google Scholar]
- [12] Siddique YH, Ara G, Beg T, Afzal M. Anti-genotoxic effect of *Ocimum sanctum* L. extract against cyproterone acetate induced genotoxic damage in cultured mammalian cells. *Acta Biol Hung.* 2007;58:397–409. [PubMed] [Google Scholar]
- [13] Jha AK, Jha M, Kaur J. Ethanolic extracts of *Ocimum sanctum*, *Azadirachta indica* and *Withania somnifera* cause apoptosis in SiHa cells. *Res J Pharm Biol Chem.* 2012;3:557–62. [Google Scholar]
- [14] 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.* 2008;49:814–22. [PubMed] [Google Scholar]
- [15] Rastogi S, Shukla Y, Paul BN, Chowdhuri DK, Khanna SK, Das M. Protective effect of *Ocimum sanctum* on 3-methylcholanthrene, 7,12-dimethylbenz (a) anthracene and aflatoxin B1 induced skin tumorigenesis in mice. *Toxicol Appl Pharmacol.* 2007;224:228–40. [PubMed] [Google Scholar]
- [16] Shah K, Verma RJ. Protection against butyl p-hydroxybenzoic acid induced oxidative stress by *Ocimum sanctum* extract in mice liver. *Acta Pol Pharm.* 2012;69:865–70. [PubMed] [Google Scholar]
- [17] Enayatallah SA, Shah SN, Bodhankar SL. A study of hepatoprotective activity of *Ocimum sanctum* (*Krishna tulas*) extracts in chemically induced liver damage in albino mice. *J Ecophysiol Occup Health.* 2004;4:89–96. [Google Scholar]
- [18] Shyamala AC, Devaki T. Studies on peroxidation in rats ingesting copper sulphate and effect of subsequent treatment with *Ocimum sanctum*. *J Clin Biochem Nutr.* 1996;20:113–9. [Google Scholar]
- [19] Bawankule DU, Pal A, Gupta S, Yadav S, Misra A, Rastogi S, et al. Protective effect of *Ocimum sanctum* on ethanol-induced oxidative stress in Swiss Albino Mice brain. *Toxicol Int.* 2008;5:121–5. [Google Scholar]
- [20] Verma P, Kedia DK, Nath A. Protective effect of *Ocimum sanctum* leaf extracts against rogor induced ovarian toxicity in *Clarias batrachus* Linn. *J Ecophysiology Occup Health.* 2007;7:177–84. [Google Scholar]
- [21] Khanna A, Shukla P, Tabassum S. Role of *Ocimum sanctum* as a genoprotective agent on chlorpyrifos-induced genotoxicity. *Toxicol Int.* 2011;18:9–13. [PMC free article] [PubMed] [Google Scholar]
- [22] Bharath BK, Anjaneyulu Y, Srilatha C. Imuuno-modulatory effect of *Ocimum sanctum* against endosulfan induced immunotoxicity. *Vet World.* 2011;4:25–7. [Google Scholar]
- [23] Mediratta PK, Tanwar K, Reeta KH, Mathur R, Benerjee BD, Singh S, et al. Attenuation of the effect of lindane on immune responses and oxidative stress by *Ocimum sanctum* seed oil (OSSO) in rats. *Indian J Physiol Pharmacol.* 2008;52:171–7. [PubMed] [Google Scholar]
- [24] Makwana M, Rathore HS. Prevention of hepatorenal toxicity of acetaminophen with *Ocimum sanctum* in mice. *Int J Pharm Technol.* 2011;3:1385–96. [Google Scholar]

- [25] Mahaprabhu R, Bhandarkar AG, Jangir BL, Rahangadale SP, Kurkure NV. Ameliorative effect of Ocimum Sanctum on meloxicam induced toxicity in wistar rats. *Toxicol Int.* 2011;18:130–6. [PMC free article] [PubMed] [Google Scholar]
- [26] Lahon K, Das S. Hepatoprotective activity of Ocimum sanctum alcoholic leaf extract against paracetamol-induced liver damage in Albino rats. *Pharmacognosy Res.* 2011;3:13–8. [PMC free article] [PubMed] [Google Scholar]
- [27] Pemminati S, Nair V, Dorababu P, Gopalakrishna HN, Pai MR. Effect of ethanolic leaf extract of Ocimum sanctum on haloperidol-induced catalepsy in albino mice. *Indian J Pharmacol.* 2007;39:87–9. [Google Scholar]
- [28] Ubaid RS, Anantrao KM, Jaju JB, Mateenuddin M. Effect of Ocimum sanctum (OS) leaf extract on hepatotoxicity induced by antitubercular drugs in rats. *Indian J Physiol Pharmacol.* 2003;47:465–70. [PubMed] [Google Scholar]
- [29] Karamala SK, Srilatha C, Anjaneyulu Y, ChandraSekharaRao TS, Sreenivasulu D, Pidugu AP. Hematobiochemical changes of lead poisoning and amelioration with Ocimum sanctum in wistar albino rats. *Vet World.* 2011;4:260–3. [Google Scholar]
- [30] Sharmila Banu G, Kumar G, Murugesan AG. Effects of leaves extract of Ocimum sanctum L. on arsenic-induced toxicity in Wistar albino rats. *Food Chem Toxicol.* 2009;47:490–5. [PubMed] [Google Scholar]
- [31] Sharma MK, Kumar M, Kumar A. Ocimum sanctum aqueous leaf extract provides protection against mercury induced toxicity in Swiss albino mice. *Indian J Exp Biol.* 2002;40:1079–82. [PubMed] [Google Scholar]
- [32] Bhartiya US, Raut YS, Joseph LJ. Protective effect of Ocimum sanctum L after high-dose 131iodine exposure in mice: An in vivo study. *Indian J Exp Biol.* 2006;44:647–52. [PubMed] [Google Scholar]
- [33] Joseph LJ, Bhartiya US, Raut YS, Hawaldar RW, Nayak Y, Pawar YP, et al. Radioprotective effect of ocimum sanctum and amifostine on the salivary gland of rats after therapeutic radioiodine exposure. *Cancer Biother Radiopharm.* 2011;26:737–43. [PubMed] [Google Scholar]
- [34] Reshma K, Kamalaksh S, Bindu YS, Pramod K, Asfa A, Amritha D, et al. Tulasi (Ocimum Sanctum) as radioprotector in head and neck cancer patients undergoing radiation therapy. *Biomedicine.* 2012;32:39–44. [Google Scholar]
- [35] 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.* 2012;4:97–104. [Google Scholar]
- [36] Uma Devi P, Ganasoundari A, Vrinda B, Srinivasan KK, Unnikrishnan MK. Radiation protection by the Ocimum flavonoids orientin and vicenin: Mechanisms of action. *Radiat Res.* 2000;154:455–60. [PubMed] [Google Scholar]
- [37] Reshma K, Rao AV, Dinesh M, Vasudevan DM. Radioprotective effects of ocimum flavonoids on leukocyte oxidants and antioxidants in oral cancer. *Indian J Clin Biochem.* 2008;23:171–5. [PMC free article] [PubMed] [Google Scholar]
- [38] Bhartiya US, Joseph LJ, Raut YS, Rao BS. Effect of Ocimum sanctum, turmeric extract and vitamin E supplementation on the salivary gland and bone marrow of radioiodine exposed mice. *Indian J Exp Biol.* 2010;48:566–71. [PubMed] [Google Scholar]
- [39] Monga J, Sharma M, Tailor N, Ganesh N. Antimelanoma and radioprotective activity of alcoholic aqueous extract of different species of Ocimum in C (57) BL mice. *Pharm Biol.* 2011;49:428–36. [PubMed] [Google Scholar]
- [40] Uma Devi P, Ganasoundari A, Rao BS, Srinivasan KK. In vivo radioprotection by ocimum flavonoids: Survival of mice. *Radiat Res.* 1999;151:74–8. [PubMed] [Google Scholar]
- [41] Nayak V, Devi PU. Protection of mouse bone marrow against radiation-induced chromosome damage and stem cell death by the ocimum flavonoids orientin and vicenin. *Radiat Res.* 2005;163:165–71. [PubMed] [Google Scholar]
- [42] Samson J, Sheeladevi R, Ravindran R. Oxidative stress in brain and antioxidant activity of Ocimum sanctum in noise exposure. *Neurotoxicology.* 2007;28:679–85. [PubMed] [Google Scholar]



- [43] Archana R, Namasivayam A. A comparative study of different crude extracts of *Ocimum sanctum* on noise stress. *Phytother Res.* 2002;16:579–80. [PubMed] [Google Scholar]
- [44] Sembulingam K, Sembulingam P, Namasivayam A. Effect of *ocimum sanctum* linn on changes in leucocytes of albino rats induced by acute noise stress. *Indian J Physiol Pharmacol.* 1999;43:137–140. [PubMed] [Google Scholar]
- [45] Sembulingam K, Sembulingam P, Namasivayam A. Effect of *Ocimum sanctum* Linn on the changes in central cholinergic system induced by acute noise stress. *J Ethnopharmacol.* 2005;96:477–82. [PubMed] [Google Scholar]
- [46] Ahmad MZ, Ali M, Mir SR. Anti-diabetic activity of *Ocimum sanctum* L. roots and isolation of new phytoconstituents using two-dimensional nuclear magnetic resonance spectroscopy. *J Pharmacogn Phytother.* 2012;4:75–85. [Google Scholar]
- [47] Singh PK, Baxi D, Banerjee S, Ramachandran AV. Therapy with methanolic extract of *Pterocarpus marsupium* Roxb and *Ocimum sanctum* Linn reverses dyslipidemia and oxidative stress in alloxan induced type I diabetic rat model. *Exp Toxicol Pathol.* 2012;64:441–8. [PubMed] [Google Scholar]
- [48] Suanarunsawat T, Songsak T. Anti-hyperglycaemic and anti-dyslipidaemic effect of dietary supplement of white *Ocimum Sanctum* Linnean before and after STZ-induced diabetes mellitus. *Int J Diabetes Metab.* 2005;13:18–23. [Google Scholar]
- [49] Suanarunsawat T, Ayutthaya WD, Songsak T, Thirawarapan S, Pongshompoo S. Lipid-lowering and antioxidative activities of aqueous extracts of *Ocimum sanctum* L. leaves in rats fed with a high-cholesterol diet. *Oxid Med Cell Longev.* 2011;2011:962025. [PMC free article] [PubMed] [Google Scholar]
- [50] Dahiya K, Sethi J, Dhankhar R, Singh V, Singh SB, Yadav M, et al. Effect of *Ocimum sanctum* on homocysteine levels and lipid profile in healthy rabbits. *Arch Physiol Biochem.* 2011;117:8–11. [PubMed] [Google Scholar]
- [51] Reddy SS, Karuna R, Baskar R, Saralakumari D. Prevention of insulin resistance by ingesting aqueous extract of *Ocimum sanctum* to fructose-fed rats. *Horm Metab Res.* 2008;40:44–9. [PubMed] [Google Scholar]
- [52] Suanarunsawat T, Ayutthaya WD, Songsak T, Rattanamahaphoom J. Anti-lipidemic actions of essential oil extracted from *Ocimum sanctum* L. leaves in rats fed with high cholesterol diet. *J Appl Biomed.* 2009;7:45–53. [Google Scholar]
- [53] Samak G, Rao MS, Kedlaya R, Vasudevan DM. Hypolipidemic efficacy of *Ocimum sanctum* in the prevention of atherogenesis in male albino rabbits. *Pharmacologyonline.* 2007;2:115–27. [Google Scholar]
- [54] Agrawal P, Rai V, Singh RB. Randomized placebo-controlled, single blind trial of holy basil leaves in patients with noninsulin-dependent diabetes mellitus. *Int J Clin Pharmacol Ther.* 1996;34:406–9. [PubMed] [Google Scholar]
- [55] Rai V, Mani UV, Iyer UM. Effect of *Ocimum sanctum* leaf powder on blood lipoproteins, glycated proteins and total amino acids in patients with non-insulin-dependent diabetes mellitus. *J Nutr Environ Med.* 1997;7:113–8. [Google Scholar]
- [56] Devra DK, Mathur KC, Agrawal RP, Bhadu I, Goyal S, Agarwal V. Effect of tulsi (*Ocimum sanctum* Linn) on clinical and biochemical parameters of metabolic syndrome. *J Nat Remedies.* 2012;12:63–7. [Google Scholar]
- [57] Kochhar A, Sharma N, Sachdeva R. Effect of supplementation of Tulsi (*Ocimum sanctum*) and Neem (*Azadirachta indica*) leaf powder on diabetic symptoms, anthropometric parameters and blood pressure of non insulin dependent male diabetics. *Ethno-Med.* 2009;3:5–9. [Google Scholar]
- [58] Dusane MB, Joshi BN. Islet protective and insulin secretion property of *Murraya koenigii* and *Ocimum tenuiflorum* in streptozotocin-induced diabetic mice. *Can J Physiol Pharmacol.* 2012;90:371–8. [PubMed] [Google Scholar]

- [59] Hannan JM, Marenah L, Ali L, Rokeya B, Flatt PR, Abdel-Wahab YH. Ocimum sanctum leaf extracts stimulate insulin secretion from perfused pancreas, isolated islets and clonal pancreatic beta-cells. *J Endocrinol.* 2006;189:127–36. [PubMed] [Google Scholar]
- [60] Chattopadhyay RR. Hypoglycemic effect of Ocimum sanctum leaf extract in normal and streptozotocin diabetic rats. *Indian J Exp Biol.* 1993;31:891–3. [PubMed] [Google Scholar]
- [61] Gholap S, Kar A. Hypoglycaemic effects of some plant extracts are possibly mediated through inhibition in corticosteroid concentration. *Pharmazie.* 2004;59:876–8. [PubMed] [Google Scholar]
- [62] Kothari A, Sharma S. Evaluation of anti-inflammatory effect of fresh tulsi leaves (*Ocimum Sanctum*) against different mediators of inflammation in albino rats. *Int J Pharm Sci Rev Res.* 2012;14:119–23. [Google Scholar]
- [63] Fernández PB, Figueredo YN, Dominguez CC, Hernández IC, Sanabria MLG, González R, et al. Anti-inflammatory effect of lyophilized aqueous extract of *Ocimum tenuiflorum* on rats. *Acta Farm Bonaerense.* 2004;23:92–7. [Google Scholar]
- [64] Thakur K, Pitre KS. Anti-inflammatory activity of extracted eugenol from *Ocimum sanctum* L. leaves. *Rasayan J Chem.* 2009;2:472–4. [Google Scholar]
- [65] Singh S, Majumdar DK. Effect of *Ocimum sanctum* fixed oil on vascular permeability and leucocytes migration. *Indian J Exp Biol.* 1999;37:1136–8. [PubMed] [Google Scholar]
- [66] Singh S, Majumdar DK. Evaluation of antiinflammatory activity of fatty acids of *Ocimum sanctum* fixed oil. *Indian J Exp Biol.* 1997;35:380–3. [PubMed] [Google Scholar]
- [67] Singh S. Comparative evaluation of antiinflammatory potential of fixed oil of different species of *Ocimum* and its possible mechanism of action. *Indian J Exp Biol.* 1998;36:1028–31. [PubMed] [Google Scholar]
- [68] Singh S, Majumdar DK. Anti-inflammatory and antipyretic activities of *Ocimum sanctum* fixed oil. *Int Pharmacogn.* 1995;33:288–92. [Google Scholar]
- [69] Kelm MA, Nair MG, Strasburg GM, DeWitt DL. Antioxidant and cyclooxygenase inhibitory phenolic compounds from *Ocimum sanctum* Linn. *Phytomedicine.* 2000;7:7–13. [PubMed] [Google Scholar]
- [70] Kalabharathi HL, Suresha RN, Pragathi B, Pushpa VH, Satish AM. Anti inflammatory activity of fresh tulsi leaves (*Ocimum Sanctum*) in albino rats. *International Journal of Pharma and Bio Sciences.* 2011;2:45–50. [Google Scholar]
- [71] Vasudevan P, Kashyap S, Sharma S. Bioactive botanicals from basil (*Ocimum* sp.) *J Sci Ind Res (C)* 1999;58:332–8. [Google Scholar]
- [72] Mediratta PK, Sharma KK, Singh S. Evaluation of immunomodulatory potential of *Ocimum sanctum* seed oil and its possible mechanism of action. *J Ethnopharmacol.* 2002;80:15–20. [PubMed] [Google Scholar]
- [73] Hemalatha R, Babu KN, Karthik M, Ramesh R, Kumar BD, Kumar PU. Immunomodulatory activity and Th1/Th2 cytokine response of *Ocimum sanctum* in myelosuppressed swiss albino mice. *Trends Med Res.* 2011;6:23–31. [Google Scholar]
- [74] Tripathi AK, Rajora VS, Gupta DK, Shukla SK. Immunomodulatory activity of *Ocimum sanctum* and its influence on cyclophosphamide induced immunosuppression. *Indian J Anim Sci.* 2008;78:33–6. [Google Scholar]
- [75] Goel A, Singh DK, Kumar S, Bhatia AK. Immunomodulating property of *Ocimum sanctum* by regulating the IL-2 production and its mRNA expression using rat's splenocytes. *Asian Pac J Trop Med.* 2010;3:8–12. [Google Scholar]
- [76] Pavaraj M, Balasubramanian V, Baskaran S, Ramasamy P. Development of immunity by extract of medicinal plant *Ocimum sanctum* on common carp *Cyprinus carpio* (L.) *Res J Immunol.* 2011;4:12–8. [Google Scholar]
- [77] Chitra G, Krishnaveni N. Immunostimulatory effect of *Ocimum sanctum* leaf extract on the Indian major carp, *Catla catla*. *Plant Archives.* 2011;11:213–4. [Google Scholar]

- [78] Mondal S, Varma S, Bamola VD, Naik SN, Mirdha BR, Padhi MM, et al. Double-blinded randomized controlled trial for immunomodulatory effects of Tulsi (*Ocimum sanctum* Linn.) leaf extract on healthy volunteers. *J Ethnopharmacol.* 2011;136:452–6. [PubMed] [Google Scholar]
- [79] Ali H, Dixit S. In vitro antimicrobial activity of flavanoids of *Ocimum sanctum* with synergistic effect of their combined form. *Asian Pac J Trop Dis.* 2012;2:S396–8. [Google Scholar]
- [80] Singh S, Malhotra M, Majumdar DK. Antibacterial activity of *Ocimum sanctum* L. fixed oil. *Indian J Exp Biol.* 2005;43:835–7. [PubMed] [Google Scholar]
- [81] Mandal S, Mandal MD, Pal NK. Enhancing chloramphenicol and trimethoprim in vitro activity by *Ocimum sanctum* Linn.(Lamiaceae) leaf extract against *Salmonella enterica* serovar Typhi. *Asian Pac J Trop Med.* 2012;5:220–4. [PubMed] [Google Scholar]
- [82] Parag S, Vijayashree N, Rami B, Patil B. Antibacterial activity of *Ocimum sanctum* Linn. and its application in water purification. *Res J Chem Environ.* 2010;14:46–50. [Google Scholar]
- [83] Farivar TN, Fard AH, Zahedani SS, Naderi M, Moud BS. Anti tuberculosis effect of *Ocimum sanctum* extracts in in vitro and macrophage culture. *J Med Sci.* 2006;6:348–51. [Google Scholar]
- [84] Shokeen P, Ray K, Bala M, Tandon V. Preliminary studies on activity of *Ocimum sanctum*, *Drynaria quercifolia*, and *Annona squamosa* against *Neisseria gonorrhoeae*. *Sex Transm Dis.* 2005;32:106–11. [PubMed] [Google Scholar]
- [85] Sawarkar HA, Khadabadi SS, Mankar DM, Farooqui IA, Jagtap NS. Development and biological evaluation of herbal anti-acne gel. *Int J PharmTech Res.* 2010;2:2028–31. [Google Scholar]
- [86] Yucharoen R, Anuchapreeda S, Tragoolpua Y. Anti-herpes simplex virus activity of extracts from the culinary herbs *Ocimum sanctum* L., *Ocimum basilicum* L. and *Ocimum americanum* L. *Afri J Biotechnol.* 2011;10:860–6. [Google Scholar]
- [87] Suzuki A, Shiota O, Mori K, Sekita S, Fuchino H, Takano A, et al. Leishmanicidal active constituents from Nepalese medicinal plant Tulsi (*Ocimum sanctum* L.) *Chem Pharm Bull (Tokyo)* 2009;57:245–51. [PubMed] [Google Scholar]
- [88] Saini A, Sharma S, Chhibber S. Induction of resistance to respiratory tract infection with *Klebsiella pneumoniae* in mice fed on a diet supplemented with tulsi (*Ocimum sanctum*) and clove (*Syzygium aromaticum*) oils. *J Microbiol Immunol Infect.* 2009;42:107–13. [PubMed] [Google Scholar]
- [89] Deo SS, Inam F, Mahashabde RP. Antimicrobial activity and HPLC fingerprinting of crude *ocimum* extracts. *E-Journal of Chemistry.* 2011;8:1430–7. [Google Scholar]
- [90] Balakumar S, Rajan S, Thirunalasundari T, Jeeva S. Antifungal activity of *Ocimum sanctum* Linn.(Lamiaceae) on clinically isolated dermatophytic fungi. *Asian Pac J Trop Med.* 2011;4:654–7. [PubMed] [Google Scholar]
- [91] Das J, Buragohain B, Srivastava RB. In vitro evaluation of *ocimum sanctum* leaf extract against dermatophytes and opportunistic fungi. *Asian J Microbiol Biotechnol Environ Sci.* 2010;12:789–92. [Google Scholar]
- [92] Chandra R, Dwivedi V, Shivam K, Jha AK. Detection of antimicrobial activity of *Ocimum sanctum* (Tulsi) and *trigonella foenum graecum* (Methi) against some selected bacterial and fungal strains. *Res J Pharm Biol Chem Sci.* 2011;2:809–13. [Google Scholar]
- [93] Rajamma AJ, Dubey S, Sateesha SB, Tiwari SN, Ghosh SK. Comparative larvicidal activity of different species of *Ocimum* against *Culex quinquefasciatus*. *Nat Prod Res.* 2011;25:1916–22. [PubMed] [Google Scholar]
- [94] Gbolade AA, Lockwood GB. Toxicity of *Ocimum sanctum* L. essential oil to *Aedes aegypti* Larvae and its chemical composition. *J Essent Oil-Bear Plants.* 2008;11:148–53. [Google Scholar]
- [95] Inbaneson SJ, Sundaram R, Suganthi P. In vitro antiplasmodial effect of ethanolic extracts of traditional medicinal plant *Ocimum* species against *Plasmodium falciparum*. *Asian Pac J Trop Med.* 2012;5:103–6. [PubMed] [Google Scholar]
- [96] Kumar S, Gupta HP, Prasad S, Rajora VS, Prasad JK. Antibacterial properties of garlic and tulsi in repeat breeding crossbred cows. *Indian Vet J.* 2011;88:28–30. [Google Scholar]

- [97] Sadekar RO, Pimprikar NM, Bhandarkar AG, Barmase BS. Immunomodulating effect of *Ocimum sanctum* linn. Dry leaf powder on humoral immune response in poultry naturally infected with IBD virus. *Indian Vet J.* 1998;75:73–4. [Google Scholar]
- [98] Deka RS. Influence of tulsi (*Ocimum sanctum*) and ashwagandha (*Withania somnifera*) supplementation on production of organic meat in goats. *Veterinary Practitioner.* 2009;10:57–9. [Google Scholar]
- [99] Bora DS, Khanikor B. Selective toxicity of *Ageratum conyzoides* and *Ocimum sanctum* against *Exorista sorbillans* (Diptera: Tachinidae) and *Antheraea ussama* (Lepidoptera: Saturniidae) *Natl Acad Sci Lett.* 2011;34:9–14. [Google Scholar]
- [100] Mishra P, Mishra S. Study of antibacterial activity of *ocimum sanctum* extract against gram positive and gram negative bacteria. *Am J Food Technol.* 2011;6:336–41. [Google Scholar]
- [101] Kumar A, Shukla R, Singh P, Dubey NK. Chemical composition, antifungal and antiaflatoxicogenic activities of *Ocimum sanctum* L. essential oil and its safety assessment as plant based antimicrobial. *Food Chem Toxicol.* 2010;48:539–43. [PubMed] [Google Scholar]
- [102] Upadhyaya S, Behera J, Tewari SN. Integrated management of foliar blast through ecofriendly formulated product, Oscect-e developed from *Ocimum sanctum* ethanolic extract. *Arch Phytopathology Plant Protect.* 2012;45:2290–300. [Google Scholar]
- [103] Kumar A, Dubey NK, Srivastava S. Antifungal evaluation of *Ocimum sanctum* essential oil against fungal deterioration of raw materials of *Rauvolfia serpentina* during storage. *Ind Crops Prod.* 2013;45:30–5. [Google Scholar]
- [104] Wani NS, Bhalerao AK, Ranaware VP, Zanje R. Formulation and evaluation of herbal sanitizer. *Int J PharmTech Res.* 2013;5:40–3. [Google Scholar]
- [105] Kukreja BJ, Dodwad V. Herbal mouthwashes-A gift of nature. *Int J Pharma Bio Sci.* 2012;3:46–52. [Google Scholar]
- [106] Malik K, Arora G, Singh I. *Ocimum sanctum* seeds, a natural superdisintegrant: Formulation and evaluation of fast melt tablets of nimesulide. *Polim Med.* 2012;42:49–59. [PubMed] [Google Scholar]
- [107] Agarwal P, Nagesh L. Comparative evaluation of efficacy of 0.2% Chlorhexidine, Listerine and Tulsi extract mouth rinses on salivary *Streptococcus mutans* count of high school children--RCT. *Contemp Clin Trials.* 2011;32:802–8. [PubMed] [Google Scholar]
- [108] Malhotra R, Grover V, Kapoor A, Saxena D. Comparison of the effectiveness of a commercially available herbal mouthrinse with chlorhexidine gluconate at the clinical and patient level. *J Indian Soc Periodontol.* 2011;15:349–52. [PMC free article] [PubMed] [Google Scholar]
- [109] Singh S, Taneja M, Majumdar DK. Biological activities of *Ocimum sanctum* L. fixed oil--an overview. *Indian J Exp Biol.* 2007;45:403–12. [PubMed] [Google Scholar]
- [110] Shetty S, Udupa S, Udupa L. Evaluation of antioxidant and wound healing effects of alcoholic and aqueous extract of *Ocimum sanctum* Linn in rats. *Evid Based Complement Alternat Med.* 2008;5:95–101. [PMC free article] [PubMed] [Google Scholar]
- [111] Goel A, Kumar S, Singh DK, Bhatia AK. Wound healing potential of *Ocimum sanctum* Linn. with induction of tumor necrosis factor-alpha. *Indian J Exp Biol.* 2010;48:402–6. [PubMed] [Google Scholar]
- [112] Kath RK, Gupta RK. Antioxidant activity of hydroalcoholic leaf extract of *ocimum sanctum* in animal models of peptic ulcer. *Indian J Physiol Pharmacol.* 2006;50:391–6. [PubMed] [Google Scholar]
- [113] Singh S, Majumdar DK. Evaluation of the gastric antiulcer activity of fixed oil of *Ocimum sanctum* (Holy Basil) *J Ethnopharmacol.* 1999;65:13–9. [PubMed] [Google Scholar]
- [114] Dharmani P, Kuchibhotla VK, Maurya R, Srivastava S, Sharma S, Palit G. Evaluation of anti-ulcerogenic and ulcer-healing properties of *Ocimum sanctum* Linn. *J Ethnopharmacol.* 2004;93:197–206. [PubMed] [Google Scholar]
- [115] Goel RK, Sairam K, Dorababu M, Prabha T, Rao CV. Effect of standardized extract of *Ocimum sanctum* Linn. on gastric mucosal offensive and defensive factors. *Indian J Exp Biol.* 2005;43:715–21. [PubMed] [Google Scholar]

- [116] Chatterjee M, Verma P, Maurya R, Palit G. Evaluation of ethanol leaf extract of *Ocimum sanctum* in experimental models of anxiety and depression. *Pharm Biol.* 2011;49:477–83. [PubMed] [Google Scholar]
- [117] Tabassum I, Siddiqui ZN, Rizvi SJ. Effects of *Ocimum sanctum* and *Camellia sinensis* on stress-induced anxiety and depression in male albino *Rattus norvegicus*. *Indian J Pharmacol.* 2010;42:283–8. [PMC free article] [PubMed] [Google Scholar]
- [118] Raghavendra M, Maiti R, Kumar S, Acharya SB. Role of *Ocimum sanctum* in the experimental model of Alzheimer's disease in rats. *Int J Green Pharm.* 2009;3:6–15. [Google Scholar]
- [119] Pemminati S, Gopalakrishna HN, Venkatesh V, Rai A, Shetty S, Vinod A, et al. Anxiolytic effect of acute administration of ursolic acid in rats. *Res J Pharm Biol Chem Sci.* 2011;2:431–7. [Google Scholar]
- [120] Moinuddin G, Devi K, Satish H, Khajuria DK. Comparative pharmacological evaluation of *Ocimum sanctum* and imipramine for antidepressant activity. *Lat Am J Pharm.* 2011;30:435–9. [Google Scholar]
- [121] Giridharan VV, Thandavarayan RA, Mani V, Ashok Dundapa T, Watanabe K, Konishi T. *Ocimum sanctum* Linn. leaf extracts inhibit acetylcholinesterase and improve cognition in rats with experimentally induced dementia. *J Med Food.* 2011;14:912–9. [PubMed] [Google Scholar]
- [122] Dokania M, Kishore K, Sharma PK. Effect of *Ocimum sanctum* extract on sodium nitrite-induced experimental amnesia in mice. *Thai J Pharma Sci.* 2011;35:123–30. [Google Scholar]
- [123] Joshi H, Parle M. Cholinergic basis of memory improving effect of *Ocimum tenuiflorum* Linn. *Indian J Pharm Sci.* 2006;68:364–5. [Google Scholar]
- [124] Bhattacharyya D, Sur TK, Jana U, Debnath PK. Controlled programmed trial of *Ocimum sanctum* leaf on generalized anxiety disorders. *Nepal Med Coll J.* 2008;10:176–9. [PubMed] [Google Scholar]
- [125] Saxena RC, Singh R, Kumar P, Negi MP, Saxena VS, Geetharani P, et al. Efficacy of an extract of *ocimum tenuiflorum* (OciBest) in the management of general stress: A double-blind, placebo-controlled study. *Evid Based Complement Alternat Med.* 2012;2012:894509. [PMC free article] [PubMed] [Google Scholar]
- [126] 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.* 2012;12:81–91. [Google Scholar]
- [127] Mishra M. *Tulsi to Save Taj Mahal from Pollution Effects.* The Times of India, Bennett Coleman and Co. Ltd. 2008 [Google Scholar]
- [128] Maller C, Townsend M, St Leger L, Henerson-Wilson C, Pryor A, Prosser L, et al. Healthy parks, healthy people: The health benefits of contact with nature in a park context. *Soc Dev.* 2009;26:51–83. [Google Scholar]
- [129] Charles C, Louv R, Bodner L, Guns B. *Children and Nature 2008. A Report on the Movement to Reconnect Children to the Natural World.* Santa Fe: Children and Nature Network; 2008. pp. 9–11. [Google Scholar]
- [130] Singh P, Mittal VK, Gupta SC. Trace elements in typical herbs as an indicator of environmental pollution. *Indian J Environ Prot.* 2003;23:1114–9. [Google Scholar]
- [131] Jürges G, Beyerle K, Tossenberger M, Häser A, Nick P. Development and validation of microscopical diagnostics for ‘Tulsi’ (*Ocimum tenuiflorum* L.) in ayurvedic preparations. *Eur Food Res Technol.* 2009;229:99–106. [Google Scholar]
- [132] Chanda D, Pal A, Shanker K. Application of HPLC fingerprints for defining in vivo safety profile of Tulsi (*Ocimum Sanctum*) Medicinal Chemistry Research. 2013;22:219–24. [Google Scholar]
- [133] United Nations Conference on Trade and Development. *Trade and Environment Review 2013. Wake Up Before It Is Too Late: Make Agriculture Truly Sustainable Now for Food Security in a Changing Climate;* Geneva, United Nations. 2013. pp. 1–7. [Google Scholar]