**"Exploring the Therapeutic Potential of Tulsi (Ocimum sanctum): A Review of Pharmacological Properties and Clinical Applications"**

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**Abstract:-**

The global burden of chronic diseases linked to lifestyle factors is a significant health concern, but Ayurveda, focusing on healthy lifestyle practices and the use of adaptogenic herbs, offers promising solutions. Among the herbs in Ayurveda, tulsi (Ocimum sanctum Linn) stands out for its confirmed health benefits supported by scientific research. Tulsi demonstrates a diverse range of pharmacological actions, making it effective in combating physical, chemical, metabolic, and psychological stressors. It shields organs and tissues from chemical and physical stress, normalizes metabolic functions, and promotes psychological well-being by enhancing memory, cognitive function, and mood regulation. Additionally, tulsi exhibits broad-spectrum antimicrobial properties, making it useful in various applications such as sanitation, wound healing, and food preservation. Cultivating tulsi not only holds spiritual significance but also offers practical solutions to societal challenges like food security, poverty, and environmental degradation. Its incorporation into daily rituals reflects the ancient wisdom of Ayurveda, providing modern solutions to contemporary health issues.

**Keywords:-**

Holy basil, Ayurveda, Lifestyle medicine, Adaptogen, Stress management, Antimicrobial, Antioxidant, Anti-inflammatory, Detoxification, Herbal medicine, Modern lifestyle

**Introduction:-**

Modern life, despite its technological wonders, is marked by pervasive stressors. The rapid pace of information exchange, driven by mobile devices and the internet, has led to a feeling of being overwhelmed by an endless stream of data. Moreover, industrial agriculture has introduced unhealthy processed foods and increased exposure to pesticides and other toxic chemicals. Urban living exacerbates these challenges with issues like wealth inequality, social isolation, and environmental pollution. Consequently, preventable lifestyle-related chronic diseases have become the leading cause of global morbidity and mortality.

In the face of this health crisis, the solutions are more likely to be found in individual homes and behaviors rather than medical facilities. Ayurveda, the world's oldest medical system, offers a holistic approach to health through healthy lifestyle practices. This ancient system emphasizes the consumption of fresh, minimally processed foods, detoxification practices, and the regular use of adaptogenic herbs, such as tulsi (Ocimum sanctum Linn).



**Fig: Tulsi (Ocimum sanctum)**

**Classification:-**

Tulsi, or Holy Basil, is classified botanically as Ocimum sanctum or Ocimum tenuiflorum. It is member of the Lamiaceae family. Within the Ocimum genus, there are several cultivars and varieties of tulsi, each with its own unique characteristics and uses. Some common cultivars include:

1. Krishna Tulsi (Ocimum tenuiflorum): Known for its dark purple leaves and strong aroma, Krishna Tulsi is often used in Ayurvedic medicine for its medicinal properties.

2. Rama Tulsi (Ocimum tenuiflorum): Rama Tulsi has green leaves and a milder flavor compared to Krishna Tulsi. It is also highly valued for its medicinal properties in traditional medicine systems.

3. Vana Tulsi (Ocimum gratissimum): Also known as Wild Forest Holy Basil, Vana Tulsi has light green leaves and a slightly spicy aroma. It is native to India and is used in Ayurvedic preparations for its therapeutic benefits.

These cultivars of tulsi may have slightly different chemical compositions and medicinal properties, but they are all highly regarded for their health-promoting properties in traditional medicine systems such as Ayurveda and Siddha.

**Synonyms:-**

1. English: Holy basil

2. Hindi: तुलसी (Tulsi)

3. Sanskrit: तुलसी (Tulsi)

4. Bengali: তুলসী (Tulsi)

5. Tamil: துளசி (Tulasi)

6. Telugu: తులసి (Tulasi)

7. Kannada: ತುಳಸಿ (Tulasi)

8. Malayalam: തുളസി (Tulasi)

9. Gujarati: તુલસી (Tulsi)

10. Marathi: तुळशी (Tulsi)

11. Punjabi: ਤੁਲਸੀ (Tulsi)

12. Urdu: تلسی (Tulsi)

13. Arabic: التلسی (Al-Tulsi)

14. French: Basilic sacré

15. Spanish: Albahaca santa

16. German: Heiliges Basilikum

17. Italian: Basilico sacro

18. Russian: Святой базилик (Svyatoy bazilik)

19. Chinese (Mandarin): 圣罗勒 (Shèng luólè)

20. Japanese: 聖バジル (Sei bajiru)

**Tulsi: The Queen of Herbs:-**

Tulsi, also known as holy basil, holds a revered status within Ayurveda. Originating in India, tulsi is hailed as "The Incomparable One" and revered for its medicinal and spiritual properties. Its diverse pharmacological actions make it effective in combating physical, chemical, metabolic, and psychological stressors. Tulsi's consumption is believed to prevent disease, promote general health, and enhance longevity. It is recommended for various conditions, including anxiety, respiratory issues, digestive problems, and skin diseases.

**Tulsi, or Holy Basil’s, chemical constituents with diverse uses:-**

|  |  |  |
| --- | --- | --- |
| Sr.no. | Chemical Constituents | uses |
| 1 | Eugenol | Acts as an anti-inflammatory, analgesic, and antioxidant. |
| 2 | Ursolic acid | Exhibits anti-inflammatory, antimicrobial, and anticancer properties. |
| 3 | Oleanolic acid | Possesses anti-inflammatory and hepatoprotective properties. |
| 4 | Apigenin | Exhibits antioxidant, anti-inflammatory, and anticancer activities. |
| 5 | Luteolin | Has antioxidant, anti-inflammatory, and neuroprotective effects. |
| 6 | Beta-caryophyllene | Functions as an anti-inflammatory and analgesic compound. |
| 7 | Caffeic acid | Shows antioxidant and anti-inflammatory properties. |
| 8 | Cineole | Acts as an expectorant and can help relieve respiratory ailments. |
| 9 | Camphene | Exhibits antimicrobial and anti-inflammatory properties. |
| 10 | Myrcene | Known for its analgesic and sedative effects. |

**Tulsi's Pharmacological Actions:-**

Scientific research has unveiled tulsi's multifaceted pharmacological actions, including antimicrobial, antioxidant, anti-inflammatory, and adaptogenic properties. It protects against chemical-induced injuries, aids in detoxification, and assists in the body's defense against infections. Tulsi's broad-spectrum activity extends to bacterial, viral, and fungal pathogens, making it invaluable in both human and animal health.

**Tulsi's Role in Stress Management:-**

Tulsi's adaptogenic nature enables it to alleviate physical, chemical, and psychological stress. Studies demonstrate its ability to enhance resilience, improve aerobic metabolism, and reduce oxidative tissue damage caused by stressors like physical exertion, cold

**Conclusion:-**

Contemporary scientific investigations into tulsi highlight its myriad psychological and physiological advantages when incorporated into one's lifestyle. This research underscores the wisdom enshrined in Hinduism and Ayurveda, which revere tulsi as a plant worthy of worship, consumption, and utilization in teas and medicinal practices as part of daily rituals. Moreover, by serving as a catalyst for ethical, sustainable, and ecological farming methods, tulsi cultivation extends beyond individual benefits to encompass wider societal, economic, and environmental concerns

**Reference:-**

1. World Health Organisation. *Preventing Chronic Diseases: A Vital Investment: WHO Global Report.* Geneva: World Health Organization; 2005.

2. Bast F, Rani P, Meena D. Chloroplast DNA phylogeography of holy basil (Ocimum tenuiflorum) in Indian subcontinent. *ScientificWorldJournal.*2014.

3. Singh N, Hoette Y, Miller R. *Tulsi: The Mother Medicine of Nature.* 2nd ed. Lucknow: International Institute of Herbal Medicine; 2010.

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.

5. Mohan L, Amberkar MV, Kumari M. Ocimum sanctum linn. (TULSI)-an overview. *Int J Pharm Sci Rev Res.*2011.

6. Pattanayak P, Behera P, Das D, Panda SK. Ocimum sanctum Linn. A reservoir plant for therapeutic applications: An overview. *Pharmacogn Rev.*2010.

7. Mondal S, Mirdha BR, Mahapatra SC. The science behind sacredness of Tulsi (Ocimum sanctum Linn.) *Indian J Physiol Pharmacol.*2009.

8. Wangcharoen W, Morasuk W. Antioxidant capacity and phenolic content of holy basil. *Songklanakarin J Sci Technol.*2007.

9. Panda VS, Naik SR. Evaluation of cardioprotective activity of Ginkgo biloba and Ocimum sanctum in rodents. *Altern Med Rev.*2009.

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.

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.

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.

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.

14. Sharma, P; Kulshreshtha, S; Sharma, A L. Anti-cataract activity of Ocimum sanctum on experimental cataract.

Indian Journal of Pharmacology, v.30, n.1, 1998.

15. Simoons, Frederick J. (1998). Plants of life, plants of death. Univ of Wisconsin Press. pp. 7-40. ISBN

9780299159047.

16. Warrier, P K (1995). Indian Medicinal Plants. Orient Longman. p. 168.

17. Wink M. Introduction Biochemistry, role and biotechnology of secondary products. In: Wink M, editor.

Biochemistry of Secondary product Metabolism. Florida: CRC press, Boca Raton; 2000. pp. 1–1

18. Kothari SK, Bhattacharya AK, Ramesh S, Garg SN, Khanuja SP. Volatile constituents in oil from different plant parts of methyl eugenol-rich Ocimum tenuiflorum Lf (syn. O. sanctum L.) grown in South India. Journal of Essential Oil Research. 2005 Nov 1; 17(6):656-8.

19. Godhwani S, Godhwani JL, Was DS. Ocimum sanctum—a preliminary study evaluating its immunoregulatory profile in albino rats. Journal of Ethnopharmacology. 1988 Dec 1; 24(2-3):193-8

20. Rana L, Tewari G, Pande C. Phytochemical and pharmacological overview on ocimum sanctum linn. Effect of growth stages.

21. Awogbindin IO, Tade OG, Metibemu SD, Olorunsogo OO, Farombi EO. Assessment of flavonoid content, free radical scavenging and hepatoprotective activities of Ocimum gratissimum and Spondias mombin in rats treated with dimethylnitrosamine. Arch Basic Appl Med. 2014 Feb 2; 2:45-54.

22. Govaerts R. World Checklist of Lamiaceae., Richmond, London, UK: Royal Botanic Gardens, Kew. 2014.

23. Naji-Tabasi S, Razavi SM. Functional properties and applications of basil seed gum: An overview. Food Hydrocolloids. 2017.

24. Skaltsa H, Tzakou O, Singh M. Note polyphenols of Ocimum sanctum from suriname. Pharmaceutical biology. 1999.

25. Nörr H, Wagner H. New constituents from Ocimum sanctum. Planta medica. 1992.

26. Ahmad A, Rasheed N, Gupta P, Singh S, Siripurapu KB, Ashraf GM, Kumar R, Chand K, Maurya R, Banu N, Al-Sheeha M. Novel Ocimumoside A and B as anti-stress agents: modulation of brain monoamines and antioxidant systems in chronic unpredictable stress model in rats. Phytomedicine. 2012

27. Kelm MA, Nair MG, Strasburg GM, DeWitt DL. Antioxidant and cyclooxygenase inhibitory phenolic compounds from Ocimum sanctum Linn. Phytomedicine. 2000

28. Grayer RJ, Veitch NC, Kite GC, Price AM, Kokubun T. Distribution of 8-oxygenated leaf-surface flavones in the genus Ocimum. Phytochemistry. 2001.

29.    Adomako-Bonsu, A. G., Chan, S. L., Pratten, M., and Fry, J. R. (2017). Antioxidant activity of rosmarinic acid and its principal metabolites in chemical and cellular systems: Importance of physico-chemical characteristics. Toxicology in vitro, 40, 248-255.

30.    Oyedemi, S. O., Oyedemi, B. O., Coopoosamy, R. M., Prieto, J. M., Stapleton, P., and Gibbons, S. (2017). Antibacterial and norfloxacin potentiation activities of Ocimum americanum L. against methicillin resistant Staphylococcus aureus. South African Journal of Botany, 109, 308-314.

31.    Pandey, R., Chandra, P., Kumar, B., Dutt, B., and Sharma, K. R. (2016). A rapid and highly sensitive method for simultaneous determination of bioactive constituents in leaf extracts of six Ocimum species using ultra high performance liquid chromatography-hybrid linear ion trap triple quadrupole mass spectrometry. Analytical Methods, 8(2), 333-341.

32.    Dhama, K., Sharun, K., Gugjoo, M. B., Tiwari, R., Alagawany, M., Iqbal Yatoo, M., and Farag, M. R. (2021). A Comprehensive Review on Chemical Profile and Pharmacological Activities of Ocimum basilicum. Food Reviews International, 1-29.

33.    Surburg, H., and Panten, J. Common Fragrance and Flavor Materials.

34.    Chiang, L. C., Ng, L. T., Cheng, P. W., Chiang, W., and Lin, C. C. (2005). Antiviral activities of extracts and selected pure constituents of Ocimum basilicum. Clinical and Experimental Pharmacology and Physiology, 32(10), 811-816.

35.    Hussain, A. I., Anwar, F., Sherazi, S. T. H., and Przybylski, R. (2008). Chemical composition, antioxidant and antimicrobial activities of basil (Ocimum basilicum) essential oils depends on seasonal variations. Food chemistry, 108(3), 986-995.

36.    Baytop, T. (1984). Therapy with Medicinal Plants in Turkey (Past and Present) No: 3255. Istanbul: Publications of the Istanbul University, 359.

37.    Mondello, L., Zappia, G., Cotroneo, A., Bonaccorsi, I., Chowdhury, J. U., Yusuf, M., and Dugo, G. (2002). Studies on the essential oil‐bearing plants of Bangladesh. Part VIII. Composition of some Ocimum oils O. basilicum L. var. purpurascens; O. sanctum L. green; O. sanctum L. purple; O. americanum L., citral type; O. americanum L., camphor type. Flavour and fragrance journal, 17(5), 335-340.

38.    Viña, A., and Murillo, E. (2003). Essential oil composition from twelve varieties of basil (Ocimum spp) grown in Colombia. Journal of the Brazilian chemical society, 14(5), 744- 749.

39.    Kéita, S. M., Vincent, C., Schmit, J. P., and Bélanger, A. (2000). Essential oil composition of Ocimum basilicum L., O. gratissimum L. and O. suave L. in the Republic of Guinea. Flavour and fragrance journal, 15(5), 339-341.

40.    Charles, D. J., and Simon, J. E. (1992). Essential oil constituents of Ocimum kilimandscharicum Guerke. Journal of essential oil Research, 4(2), 125-128.

41.    Barker, C., Dunn, H. C., and Hilditch, T. P. (1950). African drying oils. V. Some Nigerian and Sudanese drying oils. Journal of the Society of Chemical Industry, 69(3), 71-75.

42.    Sastri, B. N. (1962). The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. Raw Materials, Vol. 6: LM. The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. Raw Materials, Vol. 6: LM.

43.    Soni, N., Gill, D., Sagar, B. S., Raheja, S., and Agrawal, S. (2012). Ocimum kilimandscharicum: A systematic review. Journal of Drug Delivery and Therapeutics, 2(3).

44.    Ntezurubanza, L. J. J. C., Scheffer, J. J. C., Looman, A., and Svendsen, A. B. (1984). Composition of Essential Oil of Ocimum kilimandscharicum Grown in Rwanda1. Planta medica, 50(05), 385-388.

45.    Prakash, P. A. G. N., and Gupta, N. (2005). Therapeutic uses of Ocimum sanctum Linn (Tulsi) with a note on eugenol and its pharmacological actions: a short review. Indian journal of physiology and pharmacology, 49(2), 125.

46.    Nadkarni, K., and Nadkarni, A. K. (1976). Indian Materia Medica, Popular Prakashan Pvt. Ltd., Bombay, 1, 799.

47.    Warrier, P. K., Nambiar, V. P. K., Ramankutty, C., and Indian Medi-cinal Plants, A. (1995). A compendium of 500 species. Indian Medicinal Plants. Orient Longman Publisher, 4, 157-168.

48.    Kweka, E. J., Mosha, F. W., Lowassa, A., Mahande, A. M., Mahande, M. J., Massenga, C. P., ... and Temu, E. A. (2008). Longitudinal evaluation of Ocimum and other plants effects on the feeding behavioral response of mosquitoes (Diptera: Culicidae) in the field in Tanzania. Parasites and Vectors, 1(1), 1-8.

49.    Singh, P., Kalunke, R. M., Shukla, A., Tzfadia, O., Thulasiram, H. V., and Giri, A. P. (2020). Biosynthesis and tissue-specific partitioning of camphor and eugenol in Ocimum kilimandscharicum. Phytochemistry, 177, 112451.

50.    Awogbindin, I. O., Tade, O. G., Metibemu, S. D., Olorunsogo, O. O., and Farombi, E. O. (2014). Assessment of flavonoid content, free radical scavenging and hepatoprotective activities of Ocimum gratissimum and Spondias mombin in rats treated with dimethylnitrosamine. Arch Basic Appl Med, 2, 45-54.

51.    Dubey, N. K., Tiwari, T. N., Mandin, D., Andriamboavonjy, H., and Chaumont, J. P. (2000). Antifungal properties of Ocimum gratissimum essential oil (ethyl cinnamate chemotype). Fitoterapia, 71(5), 567-569.

52.    Akinmoladun, A. C., Ibukun, E. O., Afor, E., Obuotor, E. M., and Farombi, E. O. (2007). Phytochemical constituent and antioxidant activity of extract from the leaves of Ocimum gratissimum. Scientific Research and Essays, 2(5), 163-166.

53.    Dhawan, B. N., Patnaik, G. K., Rastogi, R. P., Singh, K. K., and Tandon, J. S. (1977). Screening of Indian plants for biological activity: part VI.

54.    Rabelo, M., Souza, E. P., Soares, P. M. G., Miranda, A. V., Matos, F. J. A., and Criddle, D. N. (2003). Antinociceptive properties of the essential oil of Ocimum gratissimum L. (Labiatae) in mice. Brazilian Journal of Medical and Biological Research, 36(4), 521- 524.

55.    Edeoga, H. O., Omosun, G., and Uche, L. C. (2006). Chemical composition of Hyptis suaveolens and Ocimum gratissimum hybrids from Nigeria. African Journal of Biotechnology, 5(10).

56.    Charles, D. J., Simon, J. E., and Wood, K. V. (1990). Essential oil constituents of Ocimum micranthum Willd. Journal of agricultural and food chemistry, 38(1), 120-122.