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THE NUTRACEUTICAL ROLE OF HOLY BASIL (TULSI) LEAVES IN PREVENTING ORAL AND CHRONIC DISEASES

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ABSTRACT

The leading cause of global morbidity and mortality is chronic disease, which is related to lifestyle. Since the COVID-19 pandemic occurred, WHO has strongly appealed, especially for developing countries, for therapy to return to using natural ingredients. For example, through a focus on healthy lifestyle practices and regular consumption of adaptogenic herbs. Of all the herbs used, Holy Basil (Tulsi) is the most superior, and scientific research now confirms its beneficial effects. Tulsi leaves have been proven to be able to overcome physical, chemical, metabolic and psychological stress. This research aims to determine the nutraceuticals of Tulsi leaves in treating oral and chronic diseases. This research uses the Systematic Literature Review method, with 6 steps, namely (1) formulating questions (based on theory); (2) Conduct searches (on Scopus, Google Scholar, EBSCO, ProQuest, and Science Direct), which published articles from 2015 to 2025; (3) Determine relevant research; (4) Determine articles that come from diverse backgrounds; (5) Data extraction from individual studies; (6) Synthesis of results using narrative methods. The results of this research are the nutraceutical synergy of Tulsi leaves was proven to be superior in protecting organs and tissues against chemical stress from industrial pollutants and heavy metals, as well as physical stress due to prolonged physical activity, ischemia, physical restraint, and exposure to excessive cold and noise. The nutraceutical synergy of Tulsi leaves has also been proven to combat metabolic stress through normalization of blood glucose, blood pressure and lipid levels (protecting the heart organ), and psychological stress through positive effects on memory and cognitive function as well as through anxiolytic, antidepressant and anticancer properties. The synergy of Tulsi's broad-spectrum antimicrobial activity is superior, including activity against various human pathogens, including pathogens that cause various oral chronic diseases (caries and periodontics). The conclusion of this research is the nutraceutical synergy of Tulsi leaves is very good in treating oral chronic diseases (oral cancer, caries and periodontics), and chronic diseases (cancer, diabetes, hypertension, cardiovascular disease and stroke), and is superior among other herbs.

Keywords: holy basil, tulsi, nutraceuticals, oral diseases, chronic diseases

INTRODUCTION

Oral and chronic diseases remain major public health challenges worldwide, contributing significantly to global morbidity and mortality rates (Luke *et al*., 2021; Patil *et al*., 2018). According to recent reports, nearly half of the global population suffers from some form of oral disease, with dental caries and periodontal diseases being the most prevalent conditions affecting quality of life and general health (Hassan *et al*., 2020). In parallel, the incidence of chronic diseases such as diabetes, cardiovascular diseases, stroke, and certain cancers continues to escalate, posing an additional burden on healthcare systems, especially in developing countries (Pascarella *et al*., 2020). The interrelationship between oral health and systemic conditions has been well established, indicating that poor oral health may contribute to the development and progression of chronic diseases (Petrocelli *et al*., 2021).

Various risk factors such as unhealthy dietary habits, inadequate oral

hygiene, tobacco use, and limited access to preventive and therapeutic care exacerbate the persistence of these diseases (Gutte & Mundhe, 2022). Despite substantial advances in conventional medical and dental treatments, many therapeutic modalities are often costly, associated with side effects, and may not be equally accessible to all population groups (Shivpuje *et al*., 2015). Furthermore, the emergence of antimicrobial resistance has intensified the urgency to explore alternative preventive and therapeutic approaches that are safer, affordable, and sustainable.

In recent years, there has been increasing scientific and clinical interest in the application of natural products and nutraceuticals as complementary strategies for health promotion and disease management (Patil *et al*., 2018). Among various medicinal plants, Tulsi holds a prominent position in traditional medicine systems such as Ayurveda due to its diverse pharmacological properties (Luke *et al*., 2021). Tulsi, a plant native to India, is widespread in tropical regions. Revered as a symbol of eternity, this sacred plant holds special significance in Hinduism, embodying perfection and possessing the power to cure ailments and guide devotees to the heavenly realms. Referenced in ancient Indian medical texts such as the Charak Samhita and Susruta Samhita, it identifies its properties in addressing Kapha and Vata imbalances (Akbar, 2020). In Indonesia, two varieties of Tulsi are known, namely Tulsi Rama and Tulsi Khrisna. The Rama Tulsi, which can also be referred to as green leaf Tulsi, is a variant of the Tulsi plant that is distinguished by its light purple blooms and its aroma, which is reminiscent of cloves. The figure of Rama Tulsi is shown in Figure 1. Khrisna Tulsi particular variety of Tulsi, which exudes an aroma similar to that of cloves, when chewed it tastes like pepper, is also referred to as purple leaf Tulsi. This particular variety of Tulsi is effective at treating a wide variety of illnesses. The figure of Krishna Tulsi is shown in Figure 2 (Suthar, 2022).

Figure 1 Rama Tulsi (*Ocimum sanctum* L.).

Figure 2 Krishna Tulsi (*Ocimum tenuiflorum* L.)

Numerous studies have demonstrated that Tulsi possesses significant anti-inflammatory, antimicrobial, antioxidant, and immunomodulatory activities, making it a promising candidate for preventing and managing both oral infections and chronic conditions (Gutte & Mundhe, 2022; Hassan *et al*., 2020). Although individual studies have explored various therapeutic aspects of Tulsi, comprehensive and systematic evidence summarizing its specific role in the integrated management of oral and chronic diseases remains limited (Pascarella *et al*., 2020; Petrocelli *et al*., 2021). There is a need to consolidate the current scientific knowledge to better understand its mechanisms of action, potential benefits, and clinical implications. Therefore, this study aims to conduct a systematic literature review to critically analyze existing research on the role of Tulsi in the prevention and management of oral and chronic diseases, thereby providing insights that can inform future research and support its potential application as a safe and effective nutraceutical agent.

RESEARCH METHOD

This research is a Systematic Literature Review, through 6 steps: (1) Developing questions (data from case studies and literature); (2) Running searches (in Scopus, Google Scholar, EBSCO, ProQuest, and

Science Direct), and journal databases with articles published from 2015 to 2025; (3) Selection of relevant research results; (4) Determine articles that come from diverse backgrounds; (5) Data extraction from individual studies; (6) Synthesis of results using narrative methods. (Libarati *et al*., 2009). Search for articles with the keywords Holy basil, Tulsi, Nutraceutical, Oral disease, and chronic disease. The way to use keywords is the "Boolean searching" method (Kurniati, 2016), namely "nutraceutical" AND "Tulsi" OR "Holy basil" AND "oral disease" AND chronic disease". The search was adjusted to the inclusion category, articles suitable for this research were: (1) purpose: Holy Basil (Tulsi) plant, (2) results: nutraceuticals for oral diseases and chronic diseases, (3) research methods: systematic literature review, qualitative, quantitative, (4) research is written in English, (5) full text is available free of charge. Meanwhile, the exclusion criteria are articles that are not suitable for this research: (1) aim: not the Holy Basil (Tulsi) plant, (2) results: not for oral diseases and chronic diseases, (3) research method: outside of systematics, qualitative literature review and quantitative (4) research written outside of English, (5) free full text not available. Followed by a review of the abstract and full article. After that, the complete reference list of the selected articles was reviewed to obtain more articles to review.

FINDINGS AND DISCUSSION

After conducting systematic literature review research, 2 articles were found that examined the nutraceuticals of Tulsi leaves (Ja and Mu), 9 articles examining protection against chronic oral diseases (Es, Ha, Ja, Ku, Mu, Pa, Tya, Ma, and Pai), 5 articles examined the anticancer properties of Tulsi leaves (De, Ha, Lu, Ma, and Pa), 10 articles researching protection against diabetes, cardiovascular disease and stroke of Tulsi leaves (Ha, Pe, Is, Ma, Su, Ku, Vi, Ja, Pa, and Ya).

Based on the fact that Tulsi has historically been used fresh and unprocessed, its nutraceutical benefits are likely the result of the interaction of a large number of active phytochemicals. Therefore, the benefits of Tulsi cannot be fully replicated using only extracts or components of the Tulsi plant. The World Health Organization (WHO) has recognized the need to broaden the Western medical perspective and has advocated for the integration of traditional health systems and traditional medicine with modern medical treatment. A significant nutraceutical role is found in Tulsi, and a holistic approach to health in prevention and treatment in chronic diseases. WHO has recommended that traditional health systems and traditional medicine be integrated with modern medical therapy, to more effectively address health problems throughout the world (Kumar et al., 2025).

1. Good Synergy of Nutraceutical Components

Tulsi leaf has been used to treat oral and chronic diseases. The advantages of Tulsi's nutraceutical synergy are primarily as anticancer, antidiabetic and antidepressant, because it is high in nutrients and eugenol. Tulsi leaves contains good nutraceuticals, has great potential to overcome oral cancer and chronic diseases, because of its potential as antimicrobial, antiviral, anti-inflammatory, antioxidant, immunomodulatory activity, because of its superior content of eugenol, linalool, ursolic acid, carracroland, terpenes, rosmarnic acid, and good nutrients such as beta carotene (vitamin A), vitamin E, vitamin K, vitamin C, folates, panthothenic acid, pyridoxine, thiamine, calcium, copper, iron, magnesium, potassium, zinc, manganese and sodium (Jamshidi & Cohen, 2017; Raghav *et al.,* 2017).

Murkar *et al.* (2023) stated that the nutraceuticals content of Tulsi leaves are vitamin C, vitamin A, calcium, phosphours, chromium, copper, zink, iron, eugenol,

ursolic acid, caryophyllene, chavicol, aromadendrene oxide, benzaldehyde, bomeol, bomyl acetate, camphor, terpineol, cubenol, cardinene, limonene, eicosane, eucalyptol, farnesene, farnesol, furaldehyde, germacrene, heptanol, humulene, limonene, butylbenzoate, ocimene, oleic acid, sabinene, selinene, phytol, veridifloro, camphene, myrcene, pinene, thujene, guaiene, gurjunene, linaool, aesculectin, aesculin, apgenin, caffeic acid, chlogenic acid, cincineol, gallic acid, galuteolin, isorientin, isovitexin, luteolin, molludistin, orientin, procatechuic acid, stigmsterol, villinin, viceni, vitexin, vllinin acid.

The antioxidant content of Tulsi leaf extract (*Ocimum tenuiflorum* L.) is higher than Tulsi leaf extract (*Ocimumm sanctum* L.) (Parajub-Baral, 2023). Research by Dewi *et al*. (2024) revealed higher phenolic and flavonoid content, indicating the natural antioxidant properties of Tulsi (*Ocimum tenuiflorum* L.), indicating its medicinal value and potential benefits in protecting against oxidative stress. The present revealed higher phenolic and flavonoid content, indicating the natural antioxidant nature of Tulsi (*Ocimum tenuiflorum* L.), signifying its medicinal importance and that it may be useful in protection against oxidative stress. The higher antioxidant potential may be due to the polyphenolic compounds such as quercitrin, 6-C-galactosylluteolin, nicotiflorin, apigenin 4'-O-glucoside, caffeic acid, genistin, myricitrin.

2. Anti Chronic Oral Disease

Chronic conditions that impact oral health are atherosclerosis, lung disease, diabetes, cancer. Meanwhile, the most common manifestations of oral disease associated with chronic disease are mucositis, xerostomia, dental caries, periodontitis, and oral cancer. Nutraceutical products provide physiological benefits, which provide health benefits that go beyond their nutritional value (Palaskar *et al*., 2023). Tulsi leaf extract is very good for orodental health, as an immunomodulator, anticancer, antimicrobial. Tulsi contains good nutraceuticals, potentially good for orodental health, such as antimicrobial, antiviral, anti-inflammatory, antioxidant, immunomodulatory activity, because it is superior in potential eugenol, linalool, ursolic acid, carracroland, terpenes, rosmarnic acid, and good nutrients such as oleic acid, linoleic acid, beta carotene, vitamin C, calcium, potassium, zinc, manganese, and sodium (Jamshidi & Cohen, 2017; Murkar *et al*., 2023). Apart from that, it has been proven to be efficacious as a medicine for toothache, periodontal disease, cariogenic, candidiasis, oral submucous fibrosis (Eswar *et al*., 2016). This happens because Tulsi has a complex chemical structure. The main active compounds that have been identified and extracted from these leaves are eugenol and ursolic acid (Tyagi *et al*., 2021). Tulsi leaves contain various compounds including flavonoids, saponins, tannins, most importantly the high content of eugenol compounds, which play an important role as antimicrobials (Hasan *et al*., 2023). Research results confirm that the leaf extract has significant potential as an oral antibacterial, and is effective against all microorganisms that cause caries (Kumar *et al*., 2022; Mallikarjun *et al*., 2016; Pai *et al*., 2022)

3. Anti-Cancer

Tulsi leaf aqueous extract is effective as an antiproliferative agent that causes apoptosis in cancer cells (Luke *et al*., 2021; Patil *et al*., 2018; Shivpuje *et al*., 2015). Tulsi leaf extract can be used as a potential anti-carcinogenic, because it has active anticancer activity, especially high eugenol content (Hasan *et al*., 2023). This effect can be attributed to the presence of abundant anticancer phytochemical compounds in Tulsi leaves, such as dimethyl benzene oleic acid, ethyl benzene camphene eugenol, linolenic acid, vicenin-2, citronellal, ocimarin, isorientin, circineol, myrecene, orientin, chlorogenicacid,

esculectin isovitexin, gallic acid, limocene, galuteolin, rosmarinic acid, vitamin C, beta carotene, calcium, phosphorus, iron, magnesium, zinc and various other micronutrients which have the ability to prevent early changes in carcinogenesis (Deshmukh *et al*., 2015; Patil *et al*., 2018; Shivpuje *et al*., 2015). Anticancer properties are achieved through several means, including inducing cell death, cell cycle arrest, inhibition of migration, metastasis, and angiogenesis in a number of cancers (Hasan *et al.,* 2023). This is due to the high concentration of metabolites that it contains, which includes flavonoids, phenolics, and terpenoids. Because of the fact that these bioactive compounds have the potential to operate as antioxidants, anticancer agents, antibacterial agents, and antidiabetic agents, it is of the utmost importance to do additional research on them (Kumar *et al.,* 2025).

4. Anti-Diabetes, Anti-Cardiovascular Disease, and Anti-Stroke

Tulsi leaf extract is known as a general vitalizer, increases immunity, and increases physical endurance (Hasan *et al*., 2023). Tulsi leaf extract is very useful for supporting the function of the heart, blood vessels and regulating blood pressure (Suthar, 2022). Tulsi leaf extract has a major effect on the treatment and prevention of cardiovascular disease, by reducing blood lipid levels, suppressing ischemia and stroke, and reducing hypertension, this occurs because of its high antioxidant content) (Kulkarni *et al*., 2018). Confirmed in the research results that Tulsi leaf extract can be heart protective and antistroke (Jamshidi & Cohen, 2017). Research by Yadav *et al*. (2023) suggests that the neuroprotective effects of Tulsi against cerebral ischemia (ischemic stroke) may be partly related to its ability to regulate brain and plasma lipids, and these findings may provide important insights into therapeutic options for cerebral ischemia or brain lesions. Tulsi has the capacity to alter atherosclerosis-related geneexpression while also providing protection against oxidative damage and inflammation due to its powerful antioxidant qualities. The plant has substantial anti-toxic properties, notably against heavy metals such as cadmium, and has promise as a natural anticoagulant similar to conventional medications (Arya *et al*., 2024).

Tulsi leaf extract has been shown to fight metabolic stress through normalizing blood glucose, blood pressure and lipid levels through positive effects on memory and cognitive function as well as through anxiolytic properties (Petrocelli *et al*., 2021). The research results confirm that the antidiabetic activity of Tulsi leaf extract is strong (Islam, 2022; Malapermal *et al*., 2017). Tulsi leaves have significant therapeutic value, research shows that Tulsi leaves can help diabetes sufferers by reducing blood sugar levels and regulating blood pressure (Suthar, 2022; Vij & Gupta, 2021).

Hydroalcoholic extract of *Ocimum tenuiflorum* L. leaves has significant anti-diabetic and anti-hyperlipidemic activities at 250 and 500 mg/kg BW against STZ and NIC-induced diabetes mellitus in rats. The anti-diabetic effect of hydroalcoholic extract of *Ocimum tenuiflorum* L. leaves is not dose dependent (Parasuraman *et al.,* 2015). This is due to the high concentration of metabolites that it contains, which includes flavonoids, phenolics, and terpenoids. Because of the fact that these bioactive compounds have the potential to operate as antioxidants, and anti-diabetic (Kumar *et al.,* 2025).

CONCLUSION

This study concluded that the nutraceutical synergy of Tulsi leaves is very good in treating chronic oral diseases (oral cancer, caries and periodontics), and chronic diseases (cancer, diabetes, cardiovascular disease and stroke), and is superior among other herbs. The nutraceuticals content of

Tulsi leaf (*Ocimum tenuiflorum* L.) is higher than Tulsi leaf (*Ocimumm sanctum* L.)

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