INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

Review On Anti-Oxidant Potential of *Gymnema sylvestre*

Febin K. P.*, Syamjith P., Dr. E. Tamil Jothi

Department of Pharmacology, Devaki Amma Memorial College of Pharmacy, Malappuram, Kerala

ARTICLE INFO

Published: 18 Mar. 2025
Keywords:
Oxidative stress related diseases, Gymnema sylvestre, Antioxidant activity, Gymnemic acid, organ protection, therapeutic potential.
DOI:
10.5281/zenodo.15046734

ABSTRACT

Oxidative stress plays a significant role in the development of chronic inflammatory diseases, such as cancer, diabetes, neurological disorders, and cardiovascular diseases, resulting from an imbalance between pro-oxidants and antioxidants. Gymnema sylvestre, a medicinal plant used in Ayurvedic medicine, offers a natural alternative to synthetic drugs for managing these conditions. Known for its antioxidant, anti-inflammatory, anti-diabetic, and hepatoprotective properties, Gymnema sylvestre contains bioactive compounds like gymnemic acids, flavonoids, and saponins that contribute to its therapeutic effects. Research highlights its strong antioxidant activity, which helps neutralize free radicals and reduce oxidative damage, particularly in diabetes and liver toxicity. The plant also demonstrates anti-inflammatory and potential anti-cancer effects, showing promise for conditions such as acute respiratory distress syndrome (ARDS) and chronic inflammation. Additionally, Gymnema sylvestre exhibits immunomodulatory effects, enhancing immune function and providing protection against oxidative stress-induced damage. It also offers protection to the liver and kidneys, making it valuable for treating organ damage caused by toxic substances. With increasing interest in natural antioxidants over synthetic alternatives, Gymnema sylvestre stands out as a promising therapeutic candidate. However, further research is needed to better understand its mechanisms and optimize its use in treating oxidative stress-related diseases.

INTRODUCTION

Oxidative stress plays a crucial role in chronic inflammatory diseases such as cancer, diabetes, neurological disorders, and cardiovascular diseases. Prolonged exposure to high levels of pro-oxidants can damage mitochondrial DNA and alter cellular components, leading to gene expression abnormalities[1]. While oxidative stress can damage the physiological and biochemical balance of tissues, a small amount of it is essential for the immune system to combat microbial infections and regulate intracellular signaling [2]. However, when free radicals exceed the body's antioxidant defense, oxidative stress worsens, further impairing tissue health[3]. Inflammation exacerbates this process by increasing reactive oxygen species (ROS), overwhelming the body's antioxidant

***Corresponding Author:** Febin K. P.
Address: *Department of Pharmacology, Devaki Amma Memorial College of Pharmacy, Malappuram, Kerala*
Email ✉: febinkparambath@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

capacity, and causing tissue damage[4]. For centuries, medicinal plants have been used to treat various ailments, especially in India, where indigenous medical systems such as Ayurveda, Siddha, and Unani have thrived. Herbalism plays a vital role in modern medicine, as synthetic drugs, while effective, often come with side effects and accessibility limitations. In contrast, herbal remedies are gaining popularity due to their low toxicity, affordability, and widespread availability, underscoring their significance in everyday healthcare[5]. According to the World Health Organization (WHO), nearly 80% of the global population relies on medicinal plants for basic healthcare, reflecting the long-standing value of herbal medicine in treating health conditions[6]. Traditional treatments for inflammatory conditions have primarily focused on combating bacterial infections, but these may not always be sufficient. As a result, complementary approaches targeting both inflammation and oxidative stress have become promising therapeutic options. Antioxidant compounds found in various foods, drinks, plants, vitamins, and minerals are essential in this context. Both traditional knowledge and modern research highlight the anti-inflammatory and antioxidant properties of medicinal plants. While conventional anti-inflammatory drugs can have side effects, herbal extracts, due to their natural origin, are considered a safer alternative. Combining anti-inflammatory and antioxidant effects in a single plant extract can significantly aid in treating chronic inflammatory diseases[7].

Gymnema sylvestre (G. sylvestre), a member of the Apocynaceae family, is a well-known antidiabetic herb used in traditional Indian medicine, particularly Ayurveda. Commonly referred to as "Gurmar," this climbing plant is found in dry forests at elevations of up to 600 meters. Its leaves are used for a range of therapeutic properties, including antidiabetic, anti-inflammatory, anti-arthritic, anti-obesity, wound-healing, and digestive benefits. G. sylvestre is rich in tannins, flavonoids, saponins, and gymnemic acid, exhibiting additional bioactive effects such as antimicrobial, larvicidal, antiviral, hypolipidemic, anticancer, and antioxidant activities, largely due to gymnemic acids—a mixture of at least 17 distinct saponins, acidic glycosides, and anthraquinones[8,9,10]. Research on the pharmacological effects of G. sylvestre is still in its early stages, and further studies are needed to fully explore its phytochemical properties. This in vitro study aims to evaluate the antioxidant and anti-inflammatory effects of ethanolic extract from G. sylvestre leaves[11]. In another study, it is stated that antioxidants are essential components in the human biological system, helping to maintain the balance between oxidation and antioxidation while neutralizing free radicals, such as reactive oxygen species, which can damage DNA and cause lipid and protein oxidation in cells. Exogenous antioxidants are primarily derived from medicinal plants, including fruits, leaves, stems, barks, and roots. Gymnema sylvestre, a perennial woody vine native to tropical Asia, China, Africa, and Australia, has been traditionally used in Ayurvedic medicine to treat various conditions, including diabetes, arthritis, anemia, hypercholesterolemia, and more. It also possesses antibacterial, anti-inflammatory, and anticancer properties. With growing concerns over the safety of synthetic antioxidants, there is an increasing interest in natural alternatives. This study aims to evaluate the antioxidant potential of the ethanolic extract of Gymnema sylvestre[12].

Plant Description

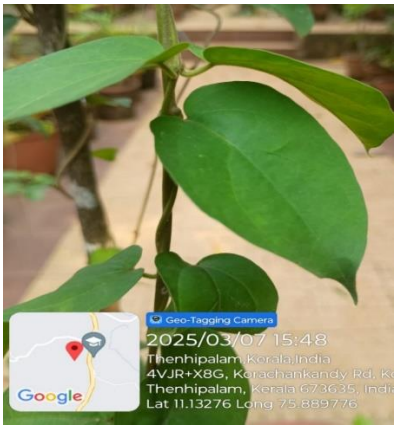

Fig No: 01: *Gymnema sylvestre*

Gymnema sylvestre is a plant included in Apocynaceae family and is located in many regions of Asia, Africa and Australia. This plant is widely used as a traditional therapy for different purposes. Gymnema sylvestre is indeed a fascinating plant with a wide range of potential health benefits, particularly when it comes to managing blood sugar levels. Its primary use in traditional medicine for diabetes management has been backed by both its historical application and emerging clinical studies. The active compounds, like gurmarin and gymnemic acid, contribute to the plant's ability to help regulate blood glucose levels. Gurmarin, for example, is thought to block sweet taste receptors on the tongue, which could reduce sugar cravings and, in turn, support blood sugar management. Gymnemic acids are also believed to aid in promoting the regeneration of insulin-producing cells in the pancreas, which might help improve insulin function. In addition to its glucose-lowering effects, the other therapeutic properties include, antioxidant, anti-inflammatory, and anti-cancer activities—add to its appeal as a natural remedy for a variety of health concerns. Its potential liver- and gut-protective properties, in particular, are promising for overall wellness[13].

Preparation Of Aqueous Extract

The leaves of *G. sylvestre* were initially washed with distilled water to remove any dirt, followed by a rinse with a mild soap solution and three additional washes with distilled water. The leaves were then blotted dry using tissue paper and shade-dried at room temperature for approximately two weeks. Once fully dried, the leaves were chopped into small pieces, powdered in a mixer, and sieved through a 20 µ mesh to obtain a uniform particle size for further analysis. A total of 20.0 g of the sieved leaf powder was combined with 100 mL of sterile distilled water in a 500 mL Erlenmeyer flask and boiled for 5 minutes. The flask was then kept in continuous darkness at 30°C. Afterward, the extract was filtered and stored in an airtight container, ensuring it was kept away from sunlight for further use[14].

Phytochemical Profile

The presence of key bioactive compounds such as alkaloids, flavonoids, phenolics, triterpenes, saponins, and tannins in *Gymnema sylvestre* highlights the plant's therapeutic potential. These compounds are known for their various medicinal properties, including antioxidant, anti-inflammatory, antimicrobial, and antidiabetic activities. The identification of the following compounds supports the further exploration of *G. sylvestre* as a source of natural bioactive agents for potential therapeutic applications[14,15].

Compound	Aqueous Extract
Alkaloids	+
Triterpenoids	+
Glycosides	_
Saponins	+
Tannins Phenols	+
Flavonoids	+
Steroids	+

Quantitative Phytochemical Analysis

Total Antioxidant Capacity

The total antioxidant capacity of the Gymnema extract can be quantified by comparing its absorbance at 695 nm to that of the gallic acid standard. The higher the absorbance, the greater the antioxidant capacity of the extract. The TAC is expressed as equivalent to ascorbic acid, a common antioxidant, allowing for a standardized comparison between different substances. The absorbance of the Gymnema extract is similar to or greater than that of the gallic acid standard, it suggests that the Gymnema extract possesses a notable antioxidant capacity. The specific concentration of ascorbic acid equivalents would depend on the measured absorbance. Thus, we can conclude that the Gymnema extract has antioxidant potential that can be compared to ascorbic acid or other antioxidants.[14,16,17]

Antioxidant Potential In Different Conditions

Hepatoprotective Activity

The study demonstrates that Gymnema sylvestre leaf extract (GSLE) has a protective effect against cisplatin (CP)-induced hepatotoxicity in rats. The administration of GSLE effectively mitigated the oxidative stress, inflammation, and apoptosis caused by CP. Specifically, GSLE reduced the elevated levels of malondialdehyde (MDA), nuclear factor-kappa B (NF-κB), tumour necrosis factor-alpha (TNF-α), and caspases (8, 9, & 12), all of which are associated with oxidative damage and cell death. Moreover, GSLE improved liver function by decreasing serum biomarkers (ALT, AST, and TBIL) and enhanced the activity of antioxidant enzymes like catalase (CAT) and superoxide dismutase (SOD). Histopathologically, GSLE administration alleviated the damage in hepatocytes, including hydropic, vacuolar, and fatty degeneration. Therefore, GSLE shows potential as a therapeutic agent to counteract CP-induced hepatotoxicity by targeting oxidative stress, inflammation, and apoptosis pathways.

the liver plays a crucial role in maintaining various vital functions, including drug metabolism, which makes it susceptible to toxicity, particularly from chemotherapy drugs like cisplatin (CP). CP-induced hepatotoxicity is primarily driven by oxidative stress, where CP generates reactive oxygen species (ROS) and inhibits antioxidant enzymes, leading to inflammation, apoptosis, and necrosis in the liver. However, natural antioxidants from plants have been shown to counteract CP-induced liver damage. Gymnema sylvestre (G. sylvestre), a medicinal plant rich in antioxidants such as tannins, phenolics, flavonoids, and gymnemic acids, has demonstrated protective effects against hepatotoxicity. Studies have highlighted the presence of various bioactive compounds in Gymnema sylvestre leaf extract (GSLE), which are thought to contribute to its hepatoprotective properties. Therefore, GSLE offers promising potential as a natural remedy to mitigate the hepatotoxic effects of CP and possibly other chemotherapy drugs, by enhancing the body's antioxidant defences and reducing oxidative stress[18]. In another study, the hydro-alcoholic extract of *Gymnema sylvestre* has demonstrated significant anti-hepatotoxic effects in vitro, as observed in isolated rat hepatocytes treated with D-galactosamine. The extract showed a dose-dependent protective response, effectively reducing liver damage as indicated by the normalization of key liver enzymes and bilirubin levels. Additionally, the methanolic extract of *Gymnema sylvestre* has been found to lower urea and creatinine levels following both acute and chronic administration in Wistar rats, suggesting its potential in supporting kidney function as well. Furthermore, a polyherbal preparation containing *Gymnema sylvestre* was shown to reverse hepatotoxicity induced by paraffin and carbon tetrachloride in albino rats. These findings highlight the hepatoprotective and nephroprotective potential of *Gymnema sylvestre*, making it a promising natural agent for mitigating liver and kidney damage caused by toxic substances[19,20]. Plant products, particularly those rich in bioactive compounds such as alkaloids, phenolics, flavonoids, and saponins, play a significant role in the healthcare industry due to their antioxidant and therapeutic potential. This study highlights the antioxidant properties of Gymnema sylvestre extract (GSE), attributed to its phenol and flavonoid content, and confirms its effectiveness as a free radical scavenger. Furthermore, GSE was shown to be non-toxic to human lymphocytes in vitro, with no DNA damage observed at the tested dose, indicating its safety. The mitogenic properties of GSE suggest that it is safe for human use and may hold potential for therapeutic applications[21]. These findings are consistent with previous research by Singh et al. (2016), who demonstrated the immunomodulatory and lymphoproliferative effects of gymnemic acid, a key compound in G. sylvestre. Thus, Gymnema sylvestre offers promising therapeutic benefits with its antioxidant, immunomodulatory, and safe properties[22].

anti-Diabetic Activity

The antidiabetic activity and antioxidant potential of *Gymnema sylvestre* R. Br have been well-documented, primarily due to the presence of flavonoids, phenols, and various bioactive compounds such as gymnemic acid, gymnemagenin, and other secondary metabolites like saponins, tannins (phenolic compounds), and triterpenoids. These compounds not only exhibit antioxidant properties but also contribute to antidiabetic effects. Literature reviews consistently highlight that these biocomponents possess both antidiabetic and antioxidant activities. Given the rising incidence of diabetes, there is an increasing need for more in-depth research and analysis to identify additional active phytochemical compounds and to better understand the precise mechanisms of action for their potential use in human health in the near future[23]. In another study, it is stated that Oxidative stress plays a significant role in the long-term complications, including vascular issues, associated with Type 2 diabetes. It refers to the excessive oxidative damage to cells, tissues, or organs caused by Reactive Oxygen Species (ROS). An imbalance between reactive species (RS) and antioxidants contributes to the development of Type 2 diabetes. In diabetes, oxidative stress disrupts enzymatic systems, causes lipid peroxidation, impairs glutathione metabolism, and reduces Vitamin C levels. ROS damages lipids, proteins, and DNA, and biomarkers such as Glutathione, Catalase, and Superoxide Dismutase (SOD) reflect this oxidative stress. Three main factors contribute to ROS generation: i) increased oxidant production, ii) decreased antioxidant defense, and iii) failure to repair oxidative damage. Both ROS and Reactive Nitrogen Species (RNS), types of free radicals, negatively regulate insulin signalling, leading to insulin resistance, a major risk factor for Type 2 diabetes. RNS has similar effects as ROS, including lipid peroxidation, non-enzymatic protein glycation, and glucose oxidation.

Given these challenges, researchers are exploring new herbal products that are affordable, easily accessible, and non-toxic. Gymnema sylvestre, a notable herb in the treatment of Type 2 diabetes, has gained attention for its presence of oleanane and dammarane-type secondary metabolites, as well as antioxidants such as flavonoids, cinnamic acid, folic acid, and ascorbic acid. With its potential health benefits and minimal side effects, Gymnema may offer an alternative medicinal approach to managing Type 2 diabetes. This review offers a detailed analysis of the antidiabetic and antioxidant properties of Gymnema sylvestre, highlighting its bioactive compounds such as oleanines (Gymnemic acid, Gymnema saponins), dammarenes (Gymnemasides), anthraquinones, flavones, hentriacontane, pentatriacontane, phytin, resin, tartaric acid, formic acid, butyric acid, lupeol, β-amyrene-related glycosides, alkaloids like gymnamine, and other antioxidants like cinnamic acid, folic acid, and ascorbic acid. Conclusion: Based on the bioactive compounds found in Gymnema sylvestre, this review aims to summarize the chemical constituents and their antidiabetic effects, focusing particularly on the connection between antioxidants and antidiabetic compounds in reducing blood sugar levels in diabetes[24]

Acute Respiratory Distress Syndrome

Cytokine storm/acute respiratory distress syndrome (ARDS) represents a critical stage in viral or bacterial lung infections. Gymnema sylvestre hydroalcoholic extract, known for its antioxidant and anti-inflammatory properties, offers protection against the cytokine storm in the Lipopolysaccharide-induced ARDS model. This is achieved by inhibiting Nrf2 mediators and modulating the NF-κB/MAPK pathway. Both the whole HAEGS and fraction 6 (F6), enriched with gymnemic acid, show potential as phytochemical treatments for ARDS and other inflammatory lung injuries[25].

Anti-Stress Activity

Stress is a physiological response of the body and mind to disruptions in homeostasis. It can be triggered by factors such as trauma, exposure to polluted air, radiation, and reactive nitrogen and oxygen species, which contribute to oxidative stress and immune dysfunction. An increase in white blood cell (leukocyte) count is a reliable biomarker for assessing stress levels in organisms. In a study, parenteral administration of milk significantly raised leukocyte count, indicating a stressful condition. However, pre-treatment with various concentrations of G. sylvestre extract in mice effectively reduced the leukocyte count induced by milk, whereas the negative control group did not show significant improvement[14].

Anticancer Activity

The results of this study suggest that Gymnema sylvestre has potential as an effective free radical scavenger, anti-inflammatory, and anticancer agent, particularly against MG63 human osteosarcoma cell lines. Therefore, G. sylvestre could serve as a natural antioxidant to help prevent oxidative stress-related degenerative diseases. In conclusion, the findings of this study revealed that the aqueous extract of G. sylvestre contains alkaloids, carbohydrates, triterpenoids, proteins, phenols, and flavonoids. The extract demonstrated significant nitrite radical scavenging, along with strong anti-inflammatory and anticancer activity against MG63 cells. These effects may be attributed to the high presence of polyphenolic compounds. This study suggests that this extract could be utilized in the development of a potent anti-inflammatory and anticancer drug[27].

Anti Inflammatory Activity

The aqueous extract of *Gymnema sylvestre* leaves (GSE) demonstrated anti-inflammatory properties in various models, including significantly reducing carrageenan-induced rat paw edema and peritoneal ascites in mice. GSE also increased liver enzymes, such as γ-glutamyl transpeptidase (γ-GT) and Superoxide dismutase (SOD), suggesting a protective effect against the release of slow-reacting substances and free radicals. However, GSE did not inhibit granuloma formation or alter related biochemical markers like hydroxyproline and collagen. Even at high doses, GSE did not compromise the integrity of the gastric mucosa, making it a less gastrotoxic anti-inflammatory agent compared to other non-steroidal anti-inflammatory drugs[28].

Immunomodulating Activity

The methanolic leaf extract of *Gymnema sylvestre* (MLEGS) demonstrated immunosuppressive effects in Swiss Albino mice, as shown by hemagglutination antibody (HA) titer, delayed-type hypersensitivity (DTH) tests, and flow cytometric analysis of B lymphocytes (CD3 and CD19) and Th2 cytokines (IL-2, IFN-γ, and IL-4). This plant extract significantly reduced both primary and secondary antibody responses, as well as DTH responses, in a dose-dependent manner. At a dosage of 200 mg/kg body weight, the maximum reductions in CD3, CD19, IL-2, IFN-γ, and IL-4 production were 31.59%, 32.12%, 29.51%, 32.45%, and 33.53%, respectively[29]. Despite these immunosuppressive effects, *Gymnema sylvestre* was also found to enhance the levels of both myeloid and lymphoid components of the immune system. The methanolic extract notably increased the production of Nitric oxide (NO) and Reactive Oxygen Species (ROS) by stimulating macrophage activity, and it also significantly reduced nitro blue tetrazolium levels[30]. Additionally, the aqueous extract of *Gymnema sylvestre* was found to stimulate the phagocytic function of human neutrophils, indicating immunostimulatory activity[31]. In another study, the ethanol extract was observed to improve immunosuppression induced by cyclophosphamide in Albino rats, significantly enhancing haemagglutination titer, phagocytic activity, and reducing paw edema compared to the cyclophosphamide-treated control group.

Furthermore, the aqueous extract exhibited potent immunostimulatory potential in another study[32].

nephroprotective Activity

Gentamicin induces oxidative stress by increasing superoxide anions and hydroxyl radicals, further promoting cell damage. It causes mesangial contraction, leading to a reduction in ultrafiltration coefficient (UF) and glomerular filtration rate (GFR), while simultaneously stimulating mesangial proliferation and apoptosis, which have opposing effects[33,34,35]. At higher doses, gentamicin does not produce significant morphological changes in the glomerulus. However, neutrophil infiltration has been linked to a slight increase in size, a shift in shape to a more rounded form, and diffuse swelling of the filtration barrier[36]. Gentamicin directly enhances the production of mitochondrial reactive oxygen species, which can damage essential cellular components such as proteins, lipids, and nucleic acids, impairing cell function and ultimately leading to cell death. Furthermore, it contributes to mesangial and vascular contraction and inflammation, highlighting that gentamicin-induced nephrotoxicity involves an inflammatory response in both experimental models and humans [37]. A study found that GA positively affected the kidney's microvasculature and exhibited antiangiogenic properties, which were linked to the expression of VEGF protein in the sectional and interlobar arteries of diabetic rodents treated with a diabetes-inducing agent[38].

Cardioprotective Activity

Antioxidant enzyme activities were assessed after homogenizing tissue in phosphate-buffered saline (PBS) with a pH of 7.0. Glutathione levels were measured using the Ellman method. Homogenized cardiac tissue was used to determine the activities of glutathione peroxidase (GPx), glutathione reductase (GR), glutathione S-transferase (GST), superoxide dismutase (SOD), and catalase. These enzyme levels were significantly elevated in Gymnema sylvestre extract treated groups compared to high fat diet group. Lipid peroxidation was evaluated spectrophotometrically by measuring the malondialdehyde equivalents using thiobarbituric acid, with the results expressed as thiobarbituric acid reactive substances (TBARS; nmol malondialdehyde/mg protein)[39]

Summary

The article focuses on the role of oxidative stress in various chronic diseases, including cancer, diabetes, cardiovascular diseases, and neurological disorders. Oxidative stress, when left unchecked, can damage tissues, mitochondrial DNA, and cellular components, leading to chronic inflammation and worsening disease progression. Medicinal plants, especially those used in traditional systems like Ayurveda, offer promising alternatives to synthetic drugs, which often have side effects. Gymnema sylvestre (G. sylvestre), a plant native to Asia, Africa, and Australia, is highlighted for its therapeutic potential due to its antioxidant, anti-inflammatory, anti-cancer, and anti-diabetic properties. The article discusses various studies that examine its pharmacological effects, focusing on its antioxidant capacity, hepatoprotective activity, anti-inflammatory properties, anti-diabetic effects, and potential in treating oxidative stress-induced conditions like Acute Respiratory Distress Syndrome (ARDS).

Gymnema sylvestre is rich in bioactive compounds such as gymnemic acids, flavonoids, tannins, saponins, and triterpenoids, which contribute to its therapeutic benefits. The plant has demonstrated significant effects in reducing oxidative stress, protecting liver function, supporting kidney health, and managing blood sugar levels. Furthermore, studies suggest that G. sylvestre has immunomodulatory effects, enhancing immune responses and reducing inflammation.

The plant's potential in managing diseases associated with oxidative stress, inflammation,

and cellular damage makes it a valuable candidate for developing natural therapies. Additionally, the low toxicity of Gymnema sylvestre makes it a safer alternative to conventional synthetic drugs.

Future Perspective:

1. **Expanded Clinical Studies**: While there is significant evidence supporting the benefits of G. sylvestre, more clinical trials and in-depth human studies are needed to confirm the plant's efficacy and safety. This will ensure that its use in treating chronic diseases, particularly diabetes, cancer, and inflammation, is substantiated with strong scientific backing.
2. **Identification of Novel Bioactive Compounds**: Further research into the phytochemical composition of Gymnema sylvestre could uncover new bioactive compounds with even more potent antioxidant and anti-inflammatory activities. This could lead to the development of novel therapeutic agents targeting oxidative stress-related diseases.
3. **Combination Therapies**: Exploring the potential of combining Gymnema sylvestre with other medicinal plants or conventional drugs could provide enhanced therapeutic effects, particularly in managing chronic diseases like diabetes and cardio
4. vascular conditions. Synergistic effects could reduce the need for higher doses of synthetic drugs and minimize side effects.
5. **Mechanistic Studies**: While preliminary studies highlight the antioxidant and anti-inflammatory effects of Gymnema sylvestre, further investigation into the specific molecular mechanisms behind these actions is essential. Understanding how it modulates oxidative stress pathways, immune responses, and cellular damage could help refine its therapeutic applications.
6. **Regulation and Standardization**: To ensure the consistent quality and potency of Gymnema sylvestre-based products, there is a need for the establishment of regulatory standards and quality control measures. This would guarantee that consumers receive safe and effective treatments derived from this plant.
7. **Public Awareness and Accessibility**: As interest in herbal medicine grows, educating the public and healthcare professionals about the potential benefits and safe use of Gymnema sylvestre could promote its adoption as a natural remedy. Additionally, efforts to improve the accessibility and affordability of Gymnema-based products could make it a widely available option for managing chronic diseases globally.

CONCLUSION

Gymnema sylvestre has a promising future as a therapeutic agent, particularly in addressing oxidative stress-related diseases. Its antioxidant, anti-inflammatory, and anti-diabetic properties position it as a valuable addition to the growing field of natural medicine. Further research will be crucial in maximizing its potential and ensuring its safe integration into modern therapeutic practices.

ACKNOWLEDGMENT

The author wish to express their gratitude to the department of Pharmacology in Devaki Amma Memorial College of Pharmacy, Chelembra, Pulliparamba (P.O), Malappuram Dist., Kerala.

REFERENCES

1. Sharifi-Rad, M., Anil Kumar, N.V., Zucca, P., et al., (2020) Lifestyle, oxidative stress, and antioxidants: Back and forth in the pathophysiology of chronic diseases. Frontiers in Physiology, 11, p.694.
2. Sies, H., Berndt, C. and Jones, D.P., (2017) Oxidative stress. annu. rev. 715-748
3. Kopáni, M., Celec, P., Danišovič, L., et al., (2006) Oxidative stress and electron spin

resonance. Clinica chimica acta, 364(1-2), pp.61-66.
4. Sies, H., (1997) Oxidative stress: oxidants and antioxidants. Experimental Physiology: Translation and Integration, 82(2), pp.291-295.
5. Das, K., Asdaq, S.M.B., Khan, M.S., et al., (2022) Phytochemical investigation and evaluation of in vitro anti-inflammatory activity of Euphorbia hirta ethanol leaf and root extracts: A comparative study. Journal of King Saud University-Science, 34(7), p.102261.
6. Dey, A., Nandy, S., Mukherjee, A. et al., (2021) Sustainable utilization of medicinal plants and conservation strategies practiced by the aboriginals of Purulia district, India: a case study on therapeutics used against some tropical otorhinolaryngologic and ophthalmic disorders. Environment, Development and Sustainability, 23, pp.5576-5613.
7. Somashekar, G., Sudhakar, U., Prakash, S.G., et al., (2022) In-vitro Antioxidant and In-vitro Anti-inflammatory activities of Ethanolic leaves extract of Ormocarpum Cochinchinense. Journal of Orofacial Sciences, 14(2), pp.134-140.
8. Sudhakar, P., Suganeswari, M., Pushkalai, P.S. et al., (2018). Regulation of Estrous cycle using Combination of Gymnema sylvestre and Pergularia daemia in Estradiol Valerate induced PCOS rats. Asian Journal of Research in Pharmaceutical Science, 8(1), pp.4-8.
9. Pachiappan, S., Ramalingam, K. and Balasubramanian, A., (2021) Combined effects of Gymnema sylvestre and Pergularia daemia on letrozole-induced polycystic ovarian syndrome in rats. Asian Pacific Journal of Reproduction, 10(2).
10. Pachiappan, S., Ramalingam, K. and Balasubramanian, A., (2023) Evaluation of Gymnema sylvestre R. Br. against Letrozole Induced Polycystic Ovarian Syndrome in rats. Research Journal of Pharmacy and Technology, 16(1), pp.385-390.
11. Sudhakar Pachiappan1, Sirisha Kodali2, SandhiyaPalanisamy1 and Sabarinath Chandrasekar2 In vitro Evaluations of Anti-inflammatory and Antioxidant Activityof Ethanolic Leaf Extract of Gymnema sylvestre R. Br. Bioscience Biotechnology Research Communications. Jan-Feb- March 2024; Vol17No (1).
12. Keerthika R, et al. Efficacy of Gymnema Sylvestre as a Potent Antioxidant: An In Vitro Study. Ann Med Health Sci Res.2021;11:232-236
13. Khan F, Sarker MMR, Ming LC, Mohamed IN, Zhao C, Sheikh BY, Tsong HF, Rashid MA. Comprehensive Review on Phytochemicals, Pharmacological and Clinical Potentials of Gymnema sylvestre. Front Pharmacol. 2019 Oct 29;10:1223 doi:10.3389/fphar.2019.01223. PMID: 31736747; PMCID: PMC6830388.
14. Arun, L.B., Arunachalam, A.M., Arunachalam, K.D. et al. In vivo anti-ulcer, anti-stress, anti-allergic, and functional properties of Gymnemic Acid Isolated from Gymnema sylvestre R Br. BMC Complement Altern Med 14, 70 (2014). https://doi.org/10.1186/1472-6882-14-70
15. Parekh J, Chanda SV: In vitro antimicrobial activity and phytochemical analysis of some Indian medicinal plants. Turk J Biotechnol 2008, 31:53–58.
16. Kumar R, Tayade A, Chaurasia O, Sunil H, Singh SB: Evaluation of anti-oxidant activities and total phenol and flavonoid content of the hydro-alcoholic extracts of Rhodiola sp. Pharmacogn J 2010, 2:431–435.
17. Salem MZ, Ali HM, El-Shanhorey N a, Abdel-Megeed A: Evaluation of extracts and essential oil from Callistemon viminalis leaves: Antibacterial and antioxidant activities, total phenolic and flavonoid contents. Asian Pac J Trop Med 2013, 6:785–791

18. Ibrahim DS. Role of Gymnema sylvestre leaf extract on hepatotoxicity induced by cisplatin in rats. Egypt J Exp Biol. 2022;18(2):163-170
19. Dholi, S. K., and Raparla, R. K. (2014). In vivo anti-diabetic evaluation of gymnemic acid in streptozotocin induced rats. J. Pharm. Innov. 3 (7), 82–86.
20. Yogi, B., and Mishra, A. (2016). Hepatoprotective effects of polyherbal formulation against carbon tetrachloride-induced hepatic injury in albino rats: a toxicity screening approach. Asian J. Pharm. Clin. Res. 10 (1), 192–198.
21. Mohammed Junaid Hussain Dowlath, Sathya R, Rengasamy S, Suresh B, et al. Protective effect of Gymnema sylvestre leaf extract against uranium toxicity in human peripheral blood mononuclear cells. J King Saud Univ Sci. 2022;34(1):101-109.
22. Singh, V.K., Dwivedi, P., Chaudhary, B.R., Singh, R., 2016. Gymnemic Acid Stimulates In Vitro Splenic Lymphocyte Proliferation. Phyther. Res. 30 (2), 341–344.
23. Laha S, Paul S. Gymnema sylvestre (Gurmar): A Potent Herb with Anti-diabetic and Antioxidant Potential. Pharmacognosy Journal. 2019;11(2):201-206
24. Suparna Laha, Santanu Paul*Gymnema sylvestre (Gurmar): A Potent Herb with Anti-Diabetic and Antioxidant Potential.Pharmacogn J. 2019; 11(2):201-206.
25. Jangam, A., Tirunavalli, S.K., Adimoolam, B.M. et al. Anti-inflammatory and antioxidant activities of Gymnema Sylvestre extract rescue acute respiratory distress syndrome in rats via modulating the NF-κB/MAPK pathway. Inflammopharmacol 31,823–844(2023). https://doi.org/10.1007/s10787-022-01133-5.
26. Lilly Baptista Arun, Aarrthy M Arunachalam, Kantha Deivi Arunachalam., et al. In vivo anti-ulcer, anti-stress, anti-allergic, and functional properties of Gymnemic Acid Isolated from Gymnema sylvestre R Br. BMC Complement Altern Med 14, 70 (2014). https://doi.org/10.1186/1472-6882-14-70.
27. B. Packialakshmi*, S. Raga Sowndriya. Anti-cancer effect of Gymnema sylvestre Leaf Extract against MG63, Human Osteosarcoma cell line - An in vitro analysi.international Journal of Current Research and Review.june2019;Vol 11(11):
28. Diwan, P.V., Margaret, I. & Ramakrishna, S. Influence of Gymnema sylvestre oninflammation. Inflammopharmacology 3,271–277(1995). https://doi.org/10.1007/BF02659124.
29. Ahirwal, L., Singh, S., Kumar, M. D., Bharti, V., Mehta, A., Shukla, S. (2015). In vivo immunomodulatory effects of the methanolic leaf extract of Gymnema sylvestre in Swiss albino mice. Arch. Biol. Sci. 67 (2), 561–570. doi: 10.2298/ABS141027018A
30. Singh, V. K., Dwivedi, P., Chaudhary, B. R., Singh, R. (2015). Immunomodulatory effect of Gymnema sylvestre (R.Br.) Leaf Extract: an in vitro study in rat model. PLoS One 10 (10), 1–15. doi: 10.1371/journal.pone.0139631
31. Jitender, K. M., Manvi, F. V., Nanjwade, B. K., Alagawadi, K. R., Sanjiv, S. (2009). Immuno-modulatory activity of Gymnema sylvestre leaves extract on In vitro human neutrophils. J. Pharmacy Res. 2 (8), 1284–1286.
32. Gupta, S. P., Pramanik, S., Tiwari, O., Thacker, N., Pande, M., Upmanyu, N. (2009). Immunomodulatory Activity of Gymnema sylvestre Leaves. Internet J. Pharmacol. 8 (2). Available online: http://ispub.com/IJPHARM/8/2/8383. doi: 10.5580/14ed
33. Pedraza-Chaverrí, J., González-Orozco, A. E., Maldonado, P. D., Barrera, D., Medina-Campos, O. N., and Hernández-Pando, R. (2003). Diallyl disulfide ameliorates gentamicin-induced oxidative stress and nephropathy in rats. Eur. J. Pharmacol. 473

(1), 71–78. doi:10.1016/s0014-2999(03)01948-4

34. Martínez-Salgado, C., Eleno, N., Morales, A. I., Pérez-Barriocanal, F., Arévalo, M., and López-Novoa, J. M. (2004). Gentamicin treatment induces simultaneous mesangial proliferation and apoptosis in rats. Kidney Int. 65 (6), 2161–2171. doi:10.1111/j.1523-1755.2004. 00642.x
35. Morales, A. I., Rodríguez-Barbero, A., Vicente-Sánchez, C., Mayoral, P., López-Novoa, J. M., and Pérez-Barriocanal, F. (2006). Resveratrol inhibits gentamicin-induced mesangial cell contraction. Life Sci. 78 (20), 2373–2377. doi: 10.1016/j.lfs.2005.09.045
36. Lopez-Novoa, J. M., Quiros, Y., Vicente, L., Morales, A. I., and Lopez-Hernandez, F. J. (2011). New insights into the mechanism of aminoglycoside nephrotoxicity: An integrative point of view. Kidney Int. 79 (1), 33–45. doi:10.1038/ki.2010.337
37. Randjelovic, P., Veljkovic, S., Stojiljkovic, N., Sokolovic, D., and Ilic, I. (2017). Gentamicin nephrotoxicity in animals: Current knowledge and future perspectives. EXCLI J. 16, 388–399. doi:10.17179/excli2017-165
38. Komolkriengkrai, M., Jangchart, R., Sandech, N., Vongvatcharanon, U., and Khimmaktong, W. (2022). Beneficial effects of gymnemic acid on three-dimensional vascular architecture and expression of vascular endothelial growth factor of intrarenal segmental and interlobar arteries in diabetic rat kidney. Funct. Foods Health Dis. 12 (6), 340–351. doi:10.31989/ffhd.v12i6.930
39. Kumar V, Bhandari U, Tripathi CD, Khanna G. Evaluation of antiobesity and cardioprotective effect of Gymnema sylvestre extract in murine model. Indian J Pharmacol. 2012 Sep-Oct;44(5):607-13. doi: 10.4103/0253-7613.100387. PMID: 23112423; PMCID: PMC3480794

HOW TO CITE: Febin K. P.*, Syamjith P., Dr. E. Tamil Jothi, Review On Anti-Oxidant Potential of Gymnema sylvestre, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 3, 1682-1692. https://doi.org/10.5281/zenodo.15046734