

Herbal approaches to alleviating diabetic neuropathic pain: A comprehensive review

Nishvanth F ^{1,*}, Manisha M ², Ayas Baba G ¹ and Priyadharshini S ¹

¹ Department of Pharmacology, Adhiparasakthi College of Pharmacy, Melmaruvathur.

² Department of Pharmacology, Faculty of Pharmacy, Dr. M. G. R. Educational research institute, Chennai, India.

World Journal of Biology Pharmacy and Health Sciences, 2025, 22(02), 030-037

Publication history: Received on 18 March 2025; revised on 29 April 2025; accepted on 01 May 2025

Article DOI: <https://doi.org/10.30574/wjbphs.2025.22.2.0449>

Abstract

Diabetic neuropathic pain (DNP) is a common and debilitating complication of diabetes, characterized by a range of sensory disturbances and chronic pain, significantly affecting the quality of life. Traditional pharmacological treatments often come with side effects and limited efficacy, prompting the exploration of alternative therapeutic strategies. Herbal medicine, with its long history of use in managing various ailments, has garnered significant attention for its potential in alleviating DNP. This comprehensive review examines the role of various herbal remedies in the management of diabetic neuropathic pain, focusing on their mechanisms of action, active compounds, and clinical evidence supporting their use. Key herbs such as Capsaicin, Turmeric, Ginger, Fenugreek, and *Bacopa monnieri* have been identified as having promising neuroprotective, anti-inflammatory, and analgesic effects. The review also discusses the potential of combining herbal treatments with conventional therapies for enhanced therapeutic outcomes. Despite the promising results, the review emphasizes the need for more robust clinical trials and standardization of herbal formulations to establish their safety, efficacy, and appropriate dosages in the management of diabetic neuropathy. This review aims to provide a detailed understanding of herbal approaches, offering insights into their potential to serve as complementary treatments for diabetic neuropathic pain.

Keywords: Diabetic neuropathic pain; Herbs; Free radicals; Neuropathy

1. Introduction

Pain; whether present or not; is an unpleasant emotional and sensory experience that is associated with or described in terms of tissue damage. Pain could be acute or chronic depending on the duration of the pain. There are estimates that pain affects 28% of people worldwide. The most resistant form of chronic pain is neuropathic pain (pain caused by damage or disease to the somatosensory system); which occurs in approximately 7–10% of the general population (Olalekan et al.; 2024). Diabetic neuropathy is a type of nerve damage that can occur in people with diabetes. It is a common complication of diabetes; affecting up to 50% of people with the condition (Narjabad et.al.; 2024). It is one of the most common complications of both insulin dependent (type 1) and non-insulin dependent (type 2) diabetes mellitus and characterised by a progressive loss of nerve fibres that predisposes the person to painful or insensitive extremities; neuropathic ulceration and amputation. The condition has a significant impact on the quality of life; mobility; and independence of individuals with diabetes (Vinik 2000; Perkins 2003).

* Corresponding author: Nishvanth F

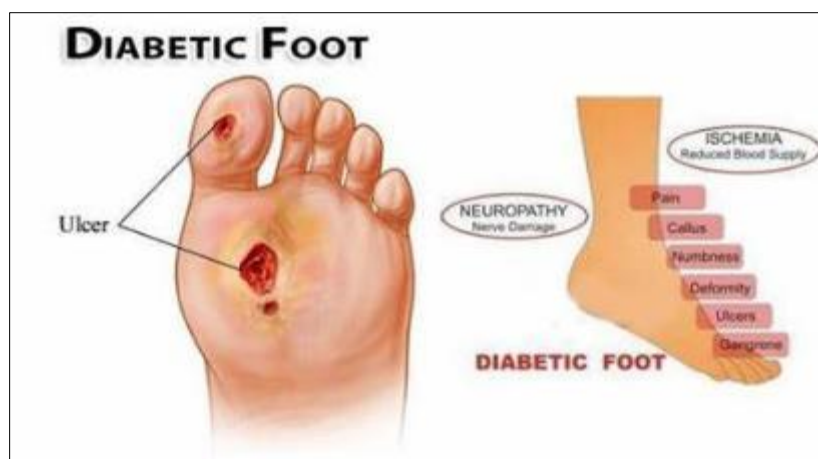


Figure 1 Diabetic foot ulcer

Diabetic neuropathy has been recognized as a complication of diabetes for centuries. The earliest descriptions of the condition date back to the 17th century; when physicians noted that people with diabetes often experienced numbness; tingling; and pain in their feet and legs. (3). Diabetic neuropathy is a major public health concern; affecting:

- **Up to 50%** of people with diabetes worldwide
- **Over 100 million** people with diabetes in India alone
- **More than 60%** of people with type 2 diabetes in India

The prevalence of diabetic neuropathy increases with the duration of diabetes; age; and poor blood sugar control.

2. Risk Factors for Diabetic Neuropathy

Several risk factors contribute to the development of diabetic neuropathy; including:

- **Duration of diabetes:** The longer a person has diabetes; the higher the risk of developing neuropathy
- **Poor blood sugar control:** High blood sugar levels can damage nerves over time
- **Age:** The risk of neuropathy increases with age
- **Smoking:** Smoking can damage nerves and blood vessels
- **High blood pressure:** Uncontrolled high blood pressure can damage blood vessels and nerves
- **High cholesterol:** High cholesterol levels can increase the risk of nerve damage

3. Pathophysiology of Diabetic Neuropathy

The exact mechanisms of diabetic neuropathy are complex and not fully understood. However; several factors are thought to contribute to the development of the condition; including:

- **Hyperglycemia:** High blood sugar levels can damage nerves through several mechanisms; including the activation of inflammatory pathways and the production of advanced glycosylation end-products (AGEs)
- **Oxidative stress:** The production of reactive oxygen species (ROS) can damage nerves and contribute to the development of neuropathy
- **Inflammation:** Chronic inflammation can damage nerves and contribute to the development of neuropathy

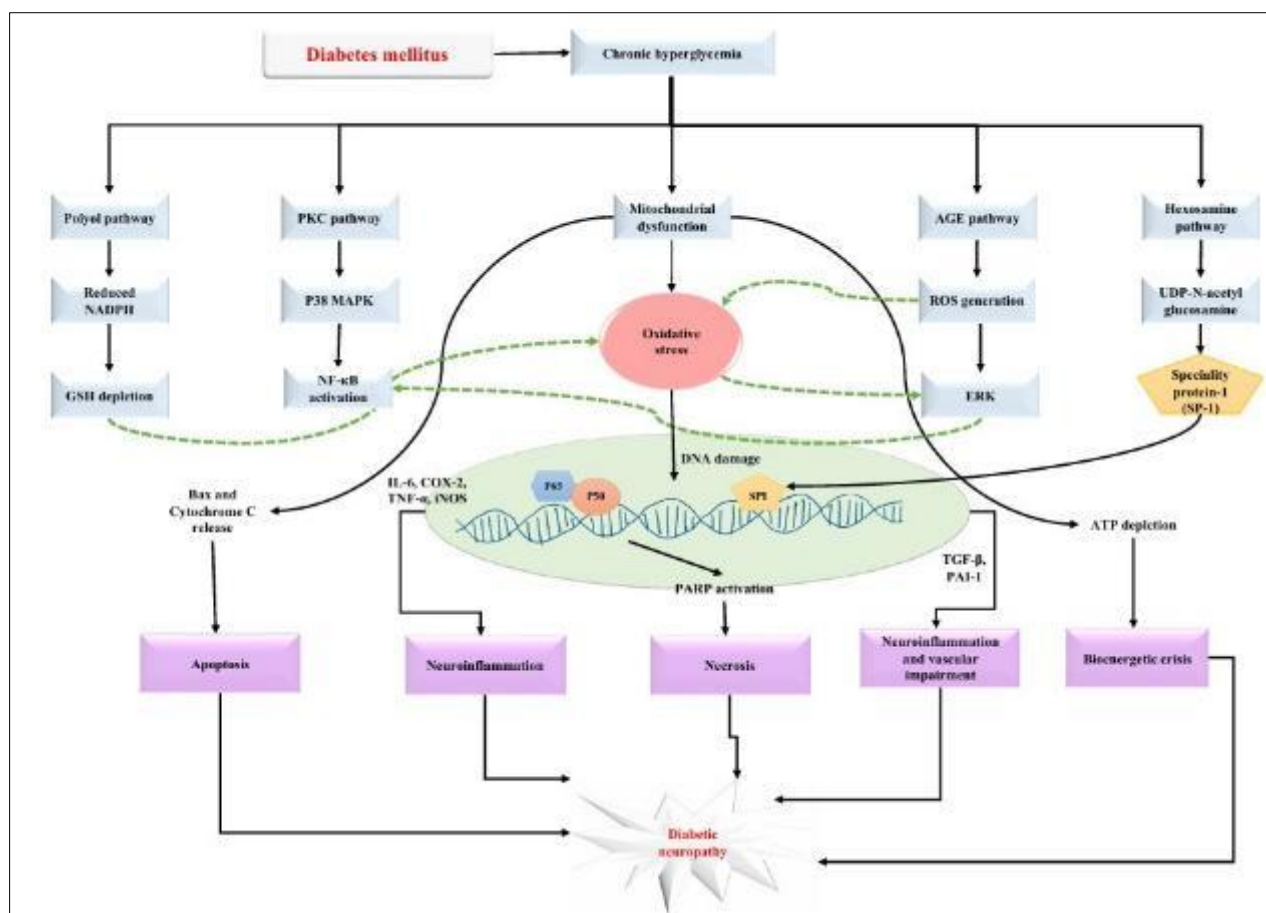


Figure 2 Pathophysiology of Diabetic neuropathy

Understanding the background and risk factors of diabetic neuropathy is essential for developing effective prevention and treatment strategies. By recognizing the signs and symptoms of neuropathy and managing blood sugar levels; individuals with diabetes can reduce their risk of developing this debilitating condition.

4. Types of diabetic neuropathy

There are several types of diabetic neuropathy; including:

- **Peripheral neuropathy:** This is the most common type of diabetic neuropathy; affecting the nerves in the feet and legs.
- **Autonomic neuropathy:** This type of neuropathy affects the nerves that control automatic functions; such as heart rate and digestion.
- **Proximal neuropathy:** This type of neuropathy affects the nerves in the thighs; hips; and buttocks.
- **Focal neuropathy:** This type of neuropathy affects a specific nerve or group of nerves.



Figure 3 Different types of diabetic neuropathy

5. Symptoms of diabetic neuropathy

The symptoms of diabetic neuropathy can vary depending on the type of neuropathy and the nerves affected. Common symptoms include:

- **Numbness or tingling:** Numbness or tingling in the feet; legs; or hands.
- **Pain:** Pain or burning sensations in the feet; legs; or hands.
- **Weakness:** Weakness or fatigue in the muscles.
- **Loss of balance:** Loss of balance or coordination (Johns Hopkins Medicine)

Table 1 Herbs to treat diabetic neuropathy

S. No	Herb	Common name	Family	Phytoconstituents
1.	<i>Acorus calamus</i> (rhizomes and leaves)	sweet flag	Acoraceae	Triterpenoid saponins (α and β asarone); sesquiterpenoids; monoterpenes; phenylpropanoids; sterols; triterpene glycosides; and alkaloids (Pranay Wal1; Priya Singh and Aparna Sinha.; 2023)
2.	<i>Alstonia scholaris</i>	Saptaparni	Apocyanaceae	flavonoids such as gallic acid; catechin; epicatechin; ellagic acid and High concentration kaempferol. (Hasandeep Singh ; Rohit Arora ; Saroj Arora ; Balbir Singh .; 2017)
3.	<i>Artemisia dracuncul</i> (Leaf)	Tarragon	Asteraceae	Polyphenols (Shahraki Mohammad Reza; Mirshekari Hamideh; and Samadi Zahra.; 2015)
4.	<i>Cannabis sativa</i> (Leaves)	Marijuana	Cannabaceae	9-tetrahydrocannabinol (Pranay Wal1; Priya Singh and Aparna Sinha.; 2023)

5.	<i>Citrullus colocynthis</i> (Fruits)	Bitter apple	Cucurbitaceae	cucurbitacin; flavonoids; alkaloids; phenolic acids (Olalekan et al.; 2024)
6.	<i>Crocus sativus</i> (Stigma)	saffron	Iridaceae	Saffron as an adjunctive therapy in combination with amitriptyline lead to improvement of neuropathic pain (Bahareh Amin; Samira Hosseini; Hossein Hosseinzadeh.; 2017)
7.	<i>Curcuma longa</i> (Rhizomes)	Turmeric	Zingiberaceae	Curcumin (Fateme Forouzanfar; Hossein Hosseinzadeh.; 2018)
8.	<i>Embllica officinalis</i>	Amla	Euphorbiaceae	Phenols; Flavonoids and Tannins such as emblicanin A; emblicanin B; punigluconin; pedunculagin and glucogallin (Lancet 2016)
9.	<i>Elaeagnus angustifolia</i> (fruit)	Russian olive	Elaeagnaceae	Flavonoids have been considered the most essential components in that have been related to anti-inflammatory activities (Gholamreza Karimi et.al.; 2010)
10.	<i>Ferula asafoetida</i> (Root)	Asafoetida	Umbelliferae	Phenolic acids; i.e.; ferulic acid and tannins (Pranay Wal1; Priya Singh and Aparna Sinha.; 2023)
11.	<i>Ginkgo biloba</i> (Leaf)	Ginkgo	Ginkgoaceae	Terpene tri lactones; that are; ginkgolides and bilobalide (Arminder Singh Saini; Rajeev Taliyan1; Pyare Lal Sharma.; 2014)
12.	<i>Momordica charantia</i> (Fruits)	Bitter gourd	Cucurbitaceae	Polysaccharides (Shih C-C; Lin CH; Lin WL; Wu JB.; 2009)
13.	<i>Mitragyna speciosa</i> (Leaf)	Kratom	Rubiaceae	Indole alkaloid – 7-Hydroxymitragynine (Fateme Forouzanfar; Hossein Hosseinzadeh.; 2018)
14.	<i>Nigella sativa</i> (Flower)	Black cumin	Ranunculaceae	Thymoquinone (Kanter M.; 2007)
15.	<i>Ocimum gratissimum</i> (Leaf)	clove basil	Lamiaceae	Essential oil such as eugenol and myrcene (Ayinla M; et al.; 2011)
16.	<i>Ocimum sanctum</i> (Leaf)	Tulsi	Lamiaceae	Saponin (Kaur G; Bali A; Singh N; Jaggi AS.; 2015)
17.	<i>Olea europaea</i> (Fruits)	olive	Oleaceae	phenolic compounds such as oleuropein (Pranay Wal1; Priya Singh and Aparna Sinha.; 2023)
18.	<i>Phoenix dactylifera</i> (Fruits)	Date palm	Arecaceae	Flavonoids; phenols; sterols; carotenoids; anthocyanins; procyanidins; cinnamic acids; and minerals like manganese; selenium and Vitamin B3 (Baliga MS; et.al. 2011)
19.	<i>Phyllanthus amarus</i> (Leaf)	Carry me seed	Euphorbiaceae	Hexanoic extract (Kassuya CA; Silvestre AA; Rehder VLG; Calixto JB.; 2003)
20.	<i>Pterodon pubescens</i> (Fruits)	Sucupira	Leguminosae	Capsaicin and cinnamaldehyde (Nucci-Martins C et.al.; 2015)
21.	<i>Rosmarinus officinalis</i> (Leaf)	Rosemary	Labiatae	Rosmarinic acid; ursolic acid; caffeic acid; carnosic acid; and other carnosol compounds (Rasoulia B et.al 2019)

22.	<i>Rubia cordifolia</i> (root; leaf; fruits; stem)	Indian madder	Rubiaceae	Methanolic extract (Patel A et.al.; 2015)
23.	<i>Salvia officinalis</i> (Leaf)	Garden sage	Lamiaceae	Flavonoids (Salvigenin) carnosol and ursolic acid/ oleanolic acid (Rodrigues MRA et.al.; 2012)
24.	<i>Tinospora cordifolia</i>	Guduchi	Menispermaceae	Magnoflorine; jatrorrhizine; and palmatine (Goel B et.al.; 2014)

Table 2 Siddha formulations used to treat diabetic neuropathy

S.No	Formulation type	Formulation name	Ingredients
1.	Ointment	Arugankattai paste (GLY CYN NEU)	Arugampul 20kg Atimaduram 100g Coconut Oil 2.5 bottle Bee's Wax required amount. (Pharmacopoeia of Hospital of Indian Medicine – SIDDHA)
2.	Both internal and external	–	D5 Chooranam; Thiripala Chooranam; Maththan thailam and Palagaraiparpam (Samraj K; Kannan M; Sathiyarajeswaran P.; 2019)
3.	Both internal and external		Raja peathiennai; Abraga chenduram; Perumarunthu + Sirukurunjan chooranam; Thiripala chooranam and Ranathylam (Sugasini P.; 2024)
4.	Internal	Triphala Churna	Fruits of Terminalia chebula; Terminalia bellirica and Emblica officinalis L (Sachin V. Suryavanshi et.al.; 2021)
5.	External	Punpurai ennai	Indian tulip tree(povarasampattai); Sulphur(gandhagam); Black cumin seeds(karunjeeragam); Indian madder (manjitti); Chebulic myrobalan (kadhukkai thol); Black cutch (kaaichukatti); Aleppo oak (masikkai); Sal tree (ven kungiliyam) and Coconut oil (thengaai ennai). (Logeswari S.; Indumathy R.; Malina Barhana R. 2025)

Table 3 Ayurvedic treatment for Diabetic neuropathy

S. No	Treatment
1.	Therapies like Padabhyangam; Lepam; Dhanyamla dhara; Jambeerapinda swedam; Patrapota swedam and Shastika pinda swedam; combined with internal medications such as Nishakatakadi kasayam; Pramehoushadi; Rasna Saptakam Kashayam; Kaisora Guggulu; Ks heerabala 101 cap and Dhanwantharam Gritam. (Chippy Soman; Marikutty T.C.; 2024)
2.	Basantkusamakarakarasa; Pramehantaka Vati; madhumehari churna; Chandraprabha Vati (Babu Lal; Ram Kishor Joshi; Abhishek Upadhyay and Devichand.; 2022)
3.	Prameha upadrava needs a dual line of treatment. (Shweta Kodre et.al. 2023)

6. Conclusion

This review suggests that herbal medicines are alternative options to relieve and manage neuropathic pain. The urgent need to find an alternative therapy that can improve neuropathic pain effectively with few side effects led scientists to explore medicines from natural sources. Diabetic neuropathy remains one of the most common and debilitating complications of diabetes; significantly impacting patients' quality of life. Despite advancements in conventional treatments; the management of diabetic neuropathy continues to pose challenges due to limited efficacy and the

potential for adverse side effects. However; emerging evidence suggests that plant-based therapies; with their antioxidant; anti-inflammatory; and neuroprotective properties; offer promising alternative treatments for managing diabetic neuropathy. Continued research into herbal medicines and other natural therapies is essential to explore their full potential in providing safer and more effective management options for diabetic neuropathy. Integrating both traditional and modern approaches may offer a more holistic and patient-centred solution to this widespread condition.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] Samuel Oluwadare Olalekan¹; Patrick Godwin Okwute; Ifabunmi Oduyemi Osonuga¹ and Muinat Moronke Adeyanju.; A review of botanical interventions for neuropathy and neuropathic pain. *Clinical Phytoscience*; (2024). <https://doi.org/10.1186/s40816-024-00385-8>.
- [2] Ourmaan Nezami Narjabad; Mina Mohebbi; Fatemeh Salamat; Maryam Zahedi; Shohre Vosoogh; Sona Ghorashi.; Efficacy of NeuroHelp Topical Herbal Medicine in Treating Painful Diabetic Neuropathy (DPN). *Journal of Experimental Neurology* 2024;5(4):172-182.
- [3] Vincent AM; Brownlee M; Russell JW. Oxidative stress and programmed cell death in diabetic neuropathy. *Annals of the New York Academy of Sciences* 2002; Apr; 959:368-83.
- [4] Perkins BA; Bril V. Diabetic neuropathy: a review emphasizing diagnostic methods. *Clinical Neurophysiology* 2003;114(7):1167-75.
- [5] O'Hare JA; Abuaisha F; Geoghegan M. Prevalence and forms of neuropathic morbidity in 800 diabetics. *Irish Journal of Medical Science* 1994;163(3):132-5.
- [6] Pranay Wal¹; Priya Singh and Aparna Sinha.; A Detailed Review of Various Herbal Treatment Options for Potentially Curing or Ameliorating Pain in Diabetic Neuropathy. *Current Traditional Medicine*; (2023). DOI: 10.2174/2215083808666220425102520.
- [7] Hasandeep Singh ; Rohit Arora ; Saroj Arora ; Balbir Singh.; Ameliorative potential of *Alstonia scholaris* (Linn.) R. Br. against chronic constriction injury-induced neuropathic pain in rats. *Complement alternative medicine*; 2017 Jan 19;17(1):63.
- [8] doi: 10.1186/s12906-017-1577-7.
- [9] Shahraki Mohammad Reza; Mirshekari Hamideh; and Samadi Zahra.; The Nociceptive and Anti-Inflammatory Effects of *Artemisia dracunculus* L. Aqueous Extract on Fructose Fed Male Rats. *Evidence-Based Complementary and Alternative Medicine* 2015;2015:895417. doi: 10.1155/2015/895417.
- [10] Bahareh Amin; Samira Hosseini; Hossein Hosseinzadeh.; Enhancement of Antinociceptive Effect by Co-administration of Amitriptyline and *Crocus Sativus* in a Rat Model of Neuropathic Pain. *Iranian journal of pharmaceutical research* 2017;16(1):187-200.
- [11] Fatemeh Forouzanfar; Hossein Hosseinzadeh.; Medicinal herbs in the treatment of neuropathic pain: a review. *Iranian Journal of Basic Medical Sciences* 2018; 21:347-358. doi: 10.22038/IJBMS.2018.24026.6021.
- [12] Vos T; Allen C; Arora M; et al. GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global; regional; and national incidence; prevalence; and years lived with disability for 310 diseases and injuries; 1990-2015: A systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; 388(10053): 1545-602. [http://dx.doi.org/10.1016/S0140-6736\(16\)31678-6](http://dx.doi.org/10.1016/S0140-6736(16)31678-6).
- [13] Gholamreza Karimi; Hossein Hosseinzadeh; Mitra Rassoulzadeh; Bibi Marjan Razavi; Elahe Taghiabadi.; Antinociceptive Effect of *Elaeagnus angustifolia* Fruits on Sciatic Nerve Ligated Mice. *Iranian Journal of Basic Medical Sciences* Vol. 13; No. 3; Summer 2010; 97-101.
- [14] Arminder Singh Saini; Rajeev Taliyan¹; Pyare Lal Sharma.; Protective effect and mechanism of *Ginkgo biloba* extract-EGb 761 on STZ-induced diabetic cardiomyopathy in rats. *Pharmacognosy Magazine*; 2014;10;38;172-178. DOI:10.4103/0973-1296.131031

- [15] Shih C-C; Lin CH; Lin WL; Wu JB. Momordica charantia extract on insulin resistance and the skeletal muscle GLUT4 protein in fructose-fed rats. J Ethnopharmacol 2009; 123(1): 82-90. <http://dx.doi.org/10.1016/j.jep.2009.02.039> PMID: 19429344.
- [16] Kanter M. Effects of Nigella sativa and its major constituent; thymoquinone on sciatic nerves in experimental diabetic neuropathy. Neurochem Res 2008;33:87-96.
- [17] Ayinla M; et al. Anti-hyperlipidemic effect of aqueous leaf extract of Ocimum gratissimum in alloxan induced diabetic rats. International Journal of Medicine and Medical Sciences 2011; 3(12): 360-3.
- [18] Kaur G; Bali A; Singh N; Jaggi AS. Ameliorative potential of Ocimum sanctum in chronic constriction injury-induced neuropathic pain in rats. Anais da Academia Brasileira de Ciências 2015;87:417-429.
- [19] Baliga MS; Baliga BRV; Kandathil SM; Bhat HP; Vayalil PK. A review of the chemistry and pharmacology of the date fruits (Phoenix dactylifera L.). Food Res Int 2011; 44(7): 1812-22. <http://dx.doi.org/10.1016/j.foodres.2010.07.004>
- [20] Rasoulzadeh B; Hajializadeh Z; Esmaili-Mahani S; Rashidipour M; Fatemi I; Kaeidi A. Neuroprotective and antinociceptive effects of rosemary (Rosmarinus officinalis L.) extract in rats with painful diabetic neuropathy. J Physiol Sci 2019; 69(1): 57-64. <http://dx.doi.org/10.1007/s12576-018-0620-x> PMID: 29754274
- [21] Kassuya CA; Silvestre AA; Rehder VL; Calixto JB. Anti allodynic and anti-oedematogenic properties of the extract and lignans from Phyllanthus amarus in models of persistent inflammatory and neuropathic pain. Eur J Pharmacol 2003;478:145-153.
- [22] Nucci-Martins C; Martins DF; Nascimento LF; Venzke D; Oliveira AS; Frederico MJ; et al. Ameliorative potential of standardized fruit extract of Pterodon pubescens Benth on neuropathic pain in mice: Evidence for the mechanisms of action. J Ethnopharmacol 2015;175:273-286.
- [23] Patel A; Patel T; Macwan C; Patel M; Chauhan K; Patel J. Evaluation of Anti-inflammatory and Analgesic activity of roots of Rubia cordifolia in rats. Journal of Pharmaceutical Sciences and Research 2010;2:809-813.
- [24] Rodrigues MRA; Kanazawa LKS; Das Neves TLM; Da Silva CF; Horst H; Pizzolatti MG; et al. Antinociceptive and anti-inflammatory potential of extract and isolated compounds from the leaves of Salvia officinalis in mice. J Ethnopharmacol 2012;139:519-526.
- [25] Goel B; Pathak N; Nim DK; Singh SK; Dixit RK; Chaurasia R. Clinical evaluation of analgesic activity of guduchi (Tinospora cordifolia) using animal model. J Clin Diagn Res 2014; 8(8): HC01-4.
- [26] Narayanaswami V; HPIM; 'Pharmacopoeia of Hospital of Indian Medicine – SIDDHA'; Tamil Nadu Siddha Medical Board; Madras-600 106; 2nd Edition-1995; Page No: 29.
- [27] Samraj K; Kannan M; Sathiyarajeswaran P.; a case report on the siddha management of diabetic foot ulcer (dfu): left plantar foot. International Journal of Research in Ayurveda and Pharmacy. 10 (2); 2019. DOI: 10.7897/2277-4343.100241
- [28] Sugasini P; Vishnu Priya K; Bose priyan S; V.Mahalakshmi and N.J. Muthukumar.; Management of Diabetic Foot Ulcer Through Siddha System of Medicine–A Case Series. Journal of Chemical Health Risks (2024) 14(6); 1231-1236 | ISSN:2251-6727.
- [29] Sachin V. Suryavanshi; Kalyani Barve; Veeranjaneyulu Addepalli; Sachin V. Utpat and Yogesh A. Kulkarni. Frontiers in pharmacology Volume 12 – 2021. <https://doi.org/10.3389/fphar.2021.662000>
- [30] Logeswari S.; Indumathy R.; Malina Barhana R. Invitro Antioxidant and Wound Healing Activity of Pun Purai Ennai; A Polyherbal Siddha Formulation. International journal of pharmaceutical sciences 2025; Vol 3; Issue 1; 1779-1786.
- [31] Chippy Soman; Marikutty T.C. An Ayurveda management of diabetic peripheral neuropathy: a vibrotherm based assessment of treatment efficacy. An International Journal of Research in AYUSH and Allied Systems. July- August 2024 Vol 11 Issue 4
- [32] Babu Lal; Ram Kishor Joshi; Abhishek Upadhyay and Devichand. An Ayurvedic approach to diabetic neuropathy – a review article. International Journal of Applied Ayurved Research. Vol V issue X sep-oct 2022.
- [33] Shweta Kodre; Jibi Varghese; Khan Aqsa Zarin; Snehal Pansare; Mohini Niware; Shreya Bhatia; Manna Mathew. Ayurveda Management in Diabetic Neuropathy vis-à-vis Prameha Upadrava–A Case Study. International Journal of Ayurvedic Medicine; Vol 14 (3); 2023; 878-884.