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Integrating Ayurveda and Modern Perspectives to Diabetic Peripheral Neuropathy and its Management: A Review Article

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ABSTRACT

Background: *Madhumeha*, a subtype of *Prameha*, is extensively described in *Ayurvedic* texts and is considered equivalent to Diabetes Mellitus. One of its most debilitating complications is Diabetic Peripheral Neuropathy (DPN), a chronic microvascular disorder leading to sensory, motor, and autonomic dysfunction. Although classical *Ayurvedic* texts do not directly describe DPN, scattered references to *Upadrava Vyadhis* (~complications) of *Prameha* mirror neuropathic symptoms such as burning sensations, numbness, tingling, muscle wasting and weakness. **Objective:** This article critically reviews *Ayurvedic* concepts of *Madhumeha* in relation to DPN and thoroughly evaluates *Ayurvedic* management strategies in the light of contemporary biomedical evidence. **Methods:** Primary *Ayurvedic* classics alongside contemporary biomedical literature on DPN pathophysiology and its management were analysed through authentic Ayurveda and modern text as well as internet sources. Electronic databases (PubMed, Scopus, AYUSH Research Portal) were searched for clinical studies on *Ayurvedic* interventions for diabetic neuropathy, including randomized controlled trials (RCTs) and systematic reviews. **Results:** *Ayurvedic* descriptions of *Avaranajanya* (obstruction of *Vata* by *Kapha/Pitta*) and *Dhatukshayaja* (~tissue depletion) *Madhumeha* provide a coherent pathophysiological model for DPN, correlating with obstruction to nerve conduction and degenerative myelin sheath damage. *Panchakarma*, *Rasayana* herbs (*Ashwagandha, Bala, Atibala, Guduchi*), and parasurgical interventions (*Jalaukavacharana*) were found to alleviate neuropathic pain, improve nerve conduction velocity and enhance quality of life in diabetic patients. **Conclusion:** Ayurveda provides both preventive and therapeutic models for DPN as an *Upadrava* of *Madhumeha*. An integrative approach combining *Nidana Parivarjana, Panchakarma, Rasayana* formulations and *Jalaukavacharana* has promising potential in management of DPN. However, robust multi-centric RCTs are essential to validate efficacy and integrate these approaches into diabetes patients globally.

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INTRODUCTION

Diabetes mellitus (DM) is an important global health issue. Around 425 million people worldwide are suffering from this disease, and this number is expected to rise in 628 million people by 2045. [1] The complications of DM are Diabetic Ketoacidosis, Diabetic Coma, Macroangiopathy, Diabetic retinopathy, Diabetic nephropathy, Diabetic neuropathy, Diabetic foot lesions. Among these, one of its most common and disabling complications is Diabetic Peripheral Neuropathy (DPN), affecting nearly 50% of long-standing diabetics. [2] DPN is characterized by symmetrical, length-dependent sensorimotor polyneuropathy resulting from chronic hyperglycaemia and microvascular injury to nerves. Clinical manifestations include numbness, burning pain, tingling, muscle wasting, autonomic dysfunction and increased risk of foot ulcers and which landups in amputations. [3] Current biomedical management

relies on glycaemic control and symptomatic drugs (antidepressants, anticonvulsants, opioids), which provide only symptomatic relief and is often limited by side effects. [4]

In Ayurveda, diabetes is described under the umbrella of *Prameha*, a group of urinary disorders marked by *Prabhuta Mutrata* (~polyuria) and *Avila Mutrata* (~turbid urine), classified among the *Ashtamahagada* (~eight difficult to cure diseases) by *Acharya Charaka* and *Sushruta*. [5,6,7] *Madhumeha*, represents the chronic stage of *Vataja Prameha* characterized by urine resembling honey in taste and colour. Though classical texts do not specifically use the term "neuropathy," several *Upadrava Vyadhis* (~complications) of *Madhumeha* closely resemble DPN symptoms, such as *Karapadadaha* (~burning sensation), *Pipeelika Sancharamiva* (~tingling), *Supti* (~numbness), and *Angasada* (~weakness). [8,9,10]

This article thoroughly reviews *Ayurvedic* and modern biomedical perspectives on DPN with respect to *Madhumeha* and evaluates integrative management approaches.

Aims & Objectives:

1. To undertake a comprehensive review of literature on diabetic neuropathy from both modern medical and *Ayurvedic* perspectives.
2. To critically examine and analyze the therapeutic approaches to diabetic neuropathy as described within the *Ayurvedic* framework.

Significance of *Prameha*, *Madhumeha* and DPN in *Ayurveda*

Prameha is classified as a chronic and incurable condition due to its *Deerghakalanubanditwa* (~chronicity), *Doshasanchayatwa* (~greater accumulation of *Doshas*), *Duschikitsithtwa* (~difficulty in treatment), *Mahamarmasrithatwa* (~involvement of vital parts) and *Bahoopadravatwa* (~additional problems). *Upadrava*, also known as complication, is an illness that occurs as a result of inappropriate management of *Pradhaana Vyadhi*, caused by the *Prakopa* of *Vata Pitta Dosha* itself. [11]

The most common form of *Prameha* is *Madhumeha*. It is a subtype of *Vataja Prameha*. If the other *Pramehas* are not treated, they will eventually menifest into *Madhumeha.* [12] All types of *Pramehas* can be collectively referred to as *Madhumeha*, as they exhibit the common characteristic of having sweet urine and a sweet taste in the body. [13] Therefore, the long-term nature and inadequate management of blood sugar levels affect the progression of *Madhumeha*, which is comparable to the causes of diabetic peripheral neuropathy (DPN).

The *Samhitas* do not provide a precise interpretation of the symptoms of DPN. However, there are just a few scattered references of the *Upadrava Vyadhis* of *Madhumeha* that closely resemble the indications and manifestations of diabetic neuropathy.

Madhumeha is arising either from *Avaranajanya* (obstruction of *Vata* by *Kapha/Pitta*) or *Dhatukshayaja* (~tissue depletion).

***Avaranajanya Madhumeha*:** Blockage of *Vata* channels by excess *Kapha* or *Pitta* leads to impaired nerve conduction, similar to ischemia and metabolic blockade in DPN.

***Dhatukshayaja Madhumeha*:** Progressive depletion of *Dhatus* and *Ojas* results in *Vata* aggravation, analogous to axonal degeneration and myelin sheath damage in neuropathy.

Diabetic Neuropathy

Diabetic neuropathy refers to the impairment of autonomic, motor, and/or sensory nerves caused by metabolic or vascular abnormalities in individuals with chronic diabetes mellitus. [14]

Pathophysiology

Modern Biomedical Perspective

The pathogenesis of DPN is multifactorial, involving:

Hyperglycemia-induced oxidative stress leading to neuronal apoptosis. [15]

Polyol pathway activation resulting in sorbitol accumulation and osmotic damage. [16]

Advanced glycation end products (AGEs) causing axonal injury and vascular dysfunction. [17]

Microangiopathy with ischemia of vasa nervorum. [18]

Neuroinflammation with cytokine dysregulation. [19]

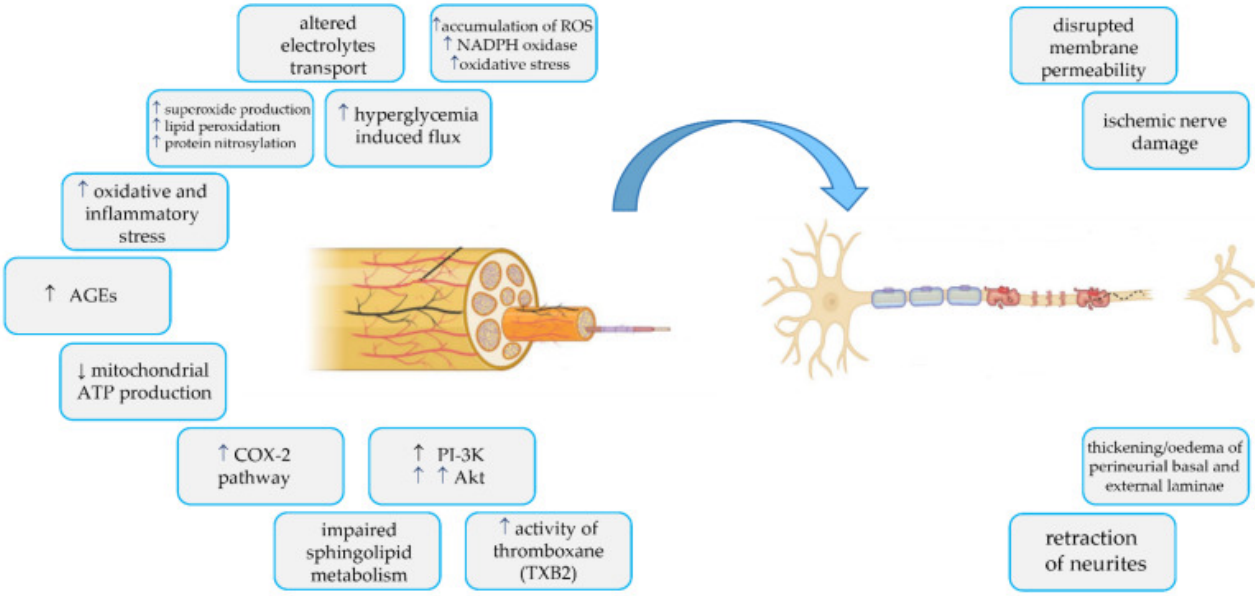

Figure 1: Main pathophysiological mechanisms of DPN. [20,21]

Madhumeha Nidana

The specific causes of *Madhumeha* include the excessive eating of heavy, oily, sour, and salty foods such as freshly harvested rice and fresh wine. This leads to the imbalance of *Kapha*, *Pitta*, *Medas* and *Mamsa*, which in turn obstructs the normal functioning of *Vata.* [22] Additionally, individuals who engage in extended periods of sleep and maintain a sedentary lifestyle are similarly susceptible to the effects of *Madhumeha*. Individuals who have ceased engaging in both physical and mental exercises, as well as those who are neglecting *Samsodhana* (~purifying therapies), are susceptible to developing *Madhumeha*. The *Basavarajiyam* mentions the excessive consumption of alcohol as *Nidana.* [23]

The psychosomatic characteristic of *Madhumeha* is described as the patient's inclination to sit while walking, to lie down while sitting, and to sleep while lying down. [24] Therefore, if the patient chooses to engage in *Avyayama* (~lack of exercise), it will result in an even greater production of defective *Medodhatu*.

Ayurvedic Samprapti [25]

Ayurveda describes a six-stage progression of *Samprapti*: *Chaya*, *Prakopa*, *Prasara*, *Sthanasamsraya*, *Vyakti* and *Bheda*. In *Madhumeha*:

Nidana: Heavy, oily, sweet foods; sedentary lifestyle; excessive alcohol.

Agnimandya: Weakening of *Jatharagni* and *Dhatwagni*.

Ama Production: Formation of *Medo-dhatu gata Ama*.

Srotodushti: Obstruction (*Sanga*) in *Rasavaha*, *Medovaha*, *Majjavaha Srotas*.

Oja Kshaya: Depletion of *Ojas* leading to neurological impairment.

The person, intaking above mentioned *Madhumeha Nidana* are prone to get *Prameha*. According to *Acharya Sushruta*, if *Prameha* is left untreated, it gets converted into *Madhumeha* and becomes incurable. *Prakupita Vata* plays an important role in *Samprapti* of *Madhumeha*. *Vata Prakopa* occurs mainly due to two causes - *Dhatu Kshaya* and *Marga Avarodha*.

Madhumeha Samprapti can be can be broadly classified into 2 types – one is *Avaranjanya* and another is *Kshayatmaka*. *Avarnajanya* is due to avaran of vitiated *Pitta* and *Kapha* and *Kshyatmaka* is due topurely vitiated *Vata*. So it is inferred that *Chala Guna* of *Vata* declines by *Avarana* of *Kapha* and *Pitta* and hindering normal nerve impulse conduction and worsening of myelin sheath.

The fatty white matter that surrounds nerve cells' axons to form the electrically insulating layer is known as the myelin sheath of neurons. Proteins make up 15 - 30% of myelin, lipids make up 70 - 85% of the dry mass, and water makes up about 40%. [26]

On later stage of disease due to *Vata Prakopa* occurs which causes *Dhatukshaya* and eventually leads to *Oja Kshaya*. As *Ojas* is the essence of *Sapta Dhatus*. *Oja* is of two type *Para* and *Apara Ojas*, *Pramana* of *Apara*

Oja is *Ardha Anjali Pramana* and is *Sleshmika* in nature, and this *Apara Oja* losses through urine in this *Vata Prakopa* stage of *Madhumeha*. In both stages, *Avaranjanya* and *Kshyajanya,* proper functioning of *Vyana Vayu* doesn't occur which leading to signs and symptoms of diabetic neuropathy. Long-term exposure to the same *Nidana* causes ongoing vitiation of *Dosha*, *Dhatu* and *Mala*. As a result, the disease advances to the point of complications that can lead to a number of different diseases collectively referred to as *Upadrava*. [27]

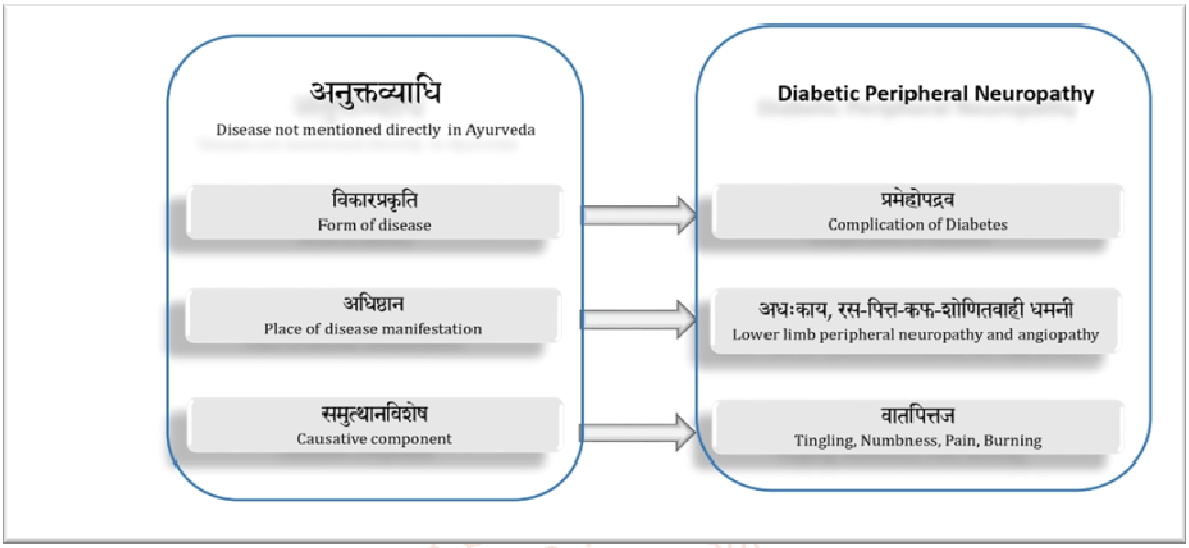

Figure 2: *Anukta Vyadhi* (~Unstated Disease)-***Ayurvedic*** **view on** ***Samprapti*** **of Diabetic Neuropathy**

Classification of Diabetic Neuropathy [28,29]

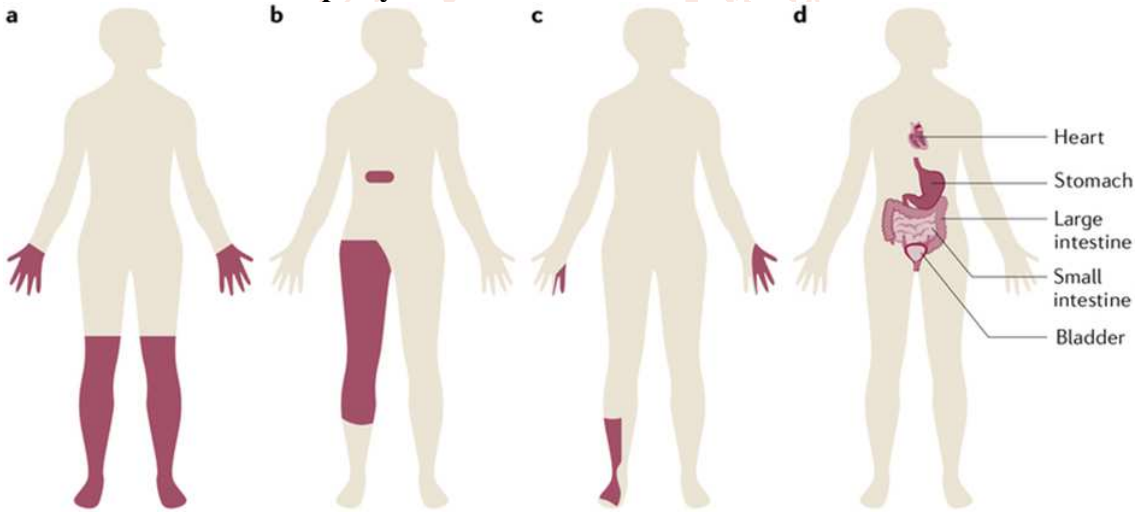

Figure 3: Patterns of nerve injury in diabetic neuropathy. [30]

There are mainly four types of neuropathies i.e. **distal symmetric peripheral neuropathy (DSP),** ***radiculoplexopathy*** or ***radiculopathy,*** **mononeuropathy, autonomic neuropathy** and the symptoms will depend upon the type of nerves affected. The symptoms usually develop gradually as it is degeneration of nerve tissue. Among these types, the most common type of neuropathy is **distal symmetric peripheral neuropathy (DSP)**. Examples of patterns of neuropathy are DSP, small-fibre-predominant neuropathy or treatment induced neuropathy (part a); ***radiculoplexopathy*** or ***radiculopathy*** (part b); **mononeuropathy** (part c); and **autonomic neuropathy** or treatment-induced neuropathy (part d). Small-fiber–predominant neuropathy shows a distribution pattern similar to distal symmetric polyneuropathy (DSP); however, the neurological findings and nerve conduction study results differ. Diabetic radiculoplexopathy or radiculopathy may respond favorably to immunotherapy and generally shows spontaneous improvement over time, unlike other diabetic neuropathies. Treatment induced neuropathy is under-recognized, is caused by overaggressive glycaemic control and can present in multiple forms (part a and d).

Madhumeha Lakshana **(~Symptoms)**

The different references of neuropathy symptoms of diabetes featured as *Purvarupa, Roopa, Updravas* of *Prameha* are mentioned as:

Analysis of symptoms of DPN in *Ayurveda*

Table 1: Sensory symptoms of neuropathy

S. N.	Symptoms	*Lakshana*	References
1.	Numbness	*Swapa/Supti*	*Medakaphavrita Vata,* [31] *Prameha Purvarupa* [32]
2.	Burning sensation	*Daha*	*Raktavrita Vata,* [33] *Prameha Purvarupa, Prameha upadrava* [34]
3.	Pricking sensation	*Suchibhirivanistoda*	*Raktavrita Vata*
4.	Heaviness of limbs	*Guruta*	*Kaphavrita Vata*
5.	Tingling sensation	*Pipeelika Sancharamiva*	*Mamsavrita Vata* [35]
6.	Abnormal pain perceptions	*Toda, Shula, Sparsavaigunya, Twak Shosham*	*Swedakshaya,* [36] *Prameha Upadrava,* [37] *Pitta Avritavata* [38]

Table 2: Motor symptoms of neuropathy

S. N.	Symptoms	*Lakshana*	References
1.	Wasting	*Mamsopachaya Shosha*	*Prameha Upadrava* [39]
2.	Weakness	*Dourbalya, Angasada*	*Prameha Upadrava* [40]
3.	Involuntary movements	*Kampa*	*Prameha Upadrava* [41]

Table 3: Autonomic symptoms of neuropathy

S. N.	Symptoms	*Lakshana*	References
1.	Constipation	*Badhapurishata*	*Prameha Upadrava*
2.	Indigestion	*Avipaka*	*Prameha Upadrava*
3.	Diarrhea	*Atisara*	*Prameha Upadrava*
4.	Thirst	*Pipasa*	*Prameha Upadrava*
5.	Anorexia	*Arochaka*	*Prameha Upadrava*
6.	Impotency	*Klaibya*	*Rasavaha Srotovikara*
7.	Fainting	*Moorchha*	*Rasavaha Srotovikara*

This symptom overlap demonstrates that Ayurveda offers a strong descriptive model for all kinds of neuropathy within the *Prameha - Madhumeha* spectrum.

Management Strategies

1. Nidana Parivarjana

Avoidance of causative factors is the main management principle for all sorts of diseases :

Prohibited foods: Meat, mutton, fish, eggs, flour products, curd, sugarcane, incompatible combinations (*Viruddha Ahara*).

Lifestyle: Avoid day sleep, prolonged sitting and sedentary habits.

Recommended: Meditate and pray for 15 minutes in the morning and evening, Walk for 1-2 km in the morning after cleansing your stomach, Make sure your stomach is properly cleansed and drink enough water, do *Surya – Namaskar - Vajrasana*, Do not stop or start any medication without consulting a doctor, Do *Udwartana* (~dry massage), *Snana*, light wholesome diet.

2. *Shodhana* (Purification)

***Vamana*:** Indicated in *Kapha*-dominant *Madhumeha*. [42]

***Virechana*:** *Pitta*-dominant cases. [43]

***Basti*:** *Anuvasana* and *Niruha Basti* to pacify aggravated *Vata* and nourish *Dhatus*. [44]

***Swedana* (sudation):** *Shashtika Shali Pinda Sweda* and *Patra Pinda Sweda* for neurological rejuvenation. [45, 46]

3. *Shamana* (Palliative Therapy)

***Rasayana* and *Vatashamaka* herbs:**

Ashwagandha (*Withania somnifera L*): Neuroprotective and regenerating myelin sheath. [47]

Bala (*Sida cordifolia*) and *Atibala* (*Abutilon indicum*): Nervine tonic. [48]

Guduchi (*Tinospora cordifolia*): Immunomodulator, anti-oxidant. [49]

Tila Taila (Sesame oil): Snayu-nourishing, emollient. [50]

4. *Jalaukavacharana* (Leech Therapy)

A randomized controlled trial demonstrated that leech therapy significantly reduced pain and improved nerve function in DPN patients, possibly via anticoagulant and anti-inflammatory effects. [51]

Discussion:

Ayurvedic texts do not have specific reference regarding DPN. *Acharya Charaka* states in aspect of *Anukta Vyadhi* (~Unstated Disease) (Figure 2: *Ayurvedic* view on *Samprapti* of Diabetic Neuropathy), whenever a physician want to diagnose or name a disease, they should consider *Samuthana Vishesha* (~causative component of the disease), *Adhisthana* (~the place of disease manifestation), and *Vikara Prakruti* (~the form of disease). [52] DPN is noticed as one of the complications of *Prameha* (~DM- Diabetes mellitus) and should be analyzed according to the predominant *Dosha* (~regulatory functional factors). According to Ayurveda, DPN is considered as *Vata Pitta* predominant stage of *Prameha*, characterized by excessive loss of the *Soumya Dhatus* (~Fundamental structural component) resulting in *Prabhuta Avila Mutrata* (~excessive turbid urination), **[53]** which causes pathological fragility in the body and leads to degeneration of the myelin sheath of the nerves. The symptoms are mainly present in the peripheries due to *Rasayani Daurbalya* (~Channel or conduit), which refers to weakening in the channels which circulate *Rasa* (~Primary circulating nutrient fluid), *Pitta* (~*Dosha* regulating body temperature and metabolic activities), *Kapha* (~*Dosha* responsible for cohesiveness) and *Shonita* (~Blood-The second of the seven fundamental structural components) as described by *Acharya Dalhana*. [54]

Acharya Sushruta, in *Dhamani Sharira Adhyaya*, describes *Adhodhamani* as the channels that descend toward the lower limbs and feet, supplying vital nutrition (~*Rasa*) and maintaining tissue vitality in the *Adhobhaga* (~lower region of the body). [55] These *Adhodhamanis* are responsible for the transport of *Rasa Dhatu* that nourishes tissues and maintains sensory and motor integrity. In *Madhumeha*, vitiated *Vata* along with obstruction of *Rasavaha* and *Medovaha Srotas* leads to reduced perfusion and *Dhatu-Kshaya*, resulting in sensory loss and degeneration in the extremities. This pathogenesis closely resembles diabetic vasculopathy, wherein microangiopathy and ischemic changes in vasa nervorum cause nerve hypoxia and axonal damage. [56,57] Thus, the *Ayurvedic* concept of *Rasavahini Dhamani Dushti* provides a parallel explanation to microvascular insufficiency and defective nutritional supply of peripheral nerves leading to neuropathy.

This integrative review reveals that *Ayurvedic* conceptualizations of *Madhumeha* correlate strongly with the pathophysiology and symptomatology of DPN. While biomedical science emphasizes oxidative stress, vascular injury and inflammation, *Ayurveda* explains the same phenomena through *Agnimandya, Ama, Avarana* and *Oja Kshaya.*

Evidence supports the clinical utility of *Ayurvedic* therapies. As it is *Margavarodhajanya Vyadhi*, due to which further *Dhatu Poshana* does not occur, *Shodhana* and *Shamana Chikitsa* plays significant role in management of Diabetic neuropathy. *Panchakarma* addresses both obstruction (removes *Ama*, clears *Srotas*) and depletion (nourishes *Dhatus*), *Rasayana* herbs enhance neuronal regeneration, improve nerve conduction velocity and reduce oxidative stress. *Jalaukavacharana* (leech therapy) is one of the *Raktamokṣhaṇa* methods indicated in *Vata-Pittaja* and *Dushta Raktaja Vyadhi* of the lower limbs. [58] Its mechanism includes *Raktashuddhi, Srotoshodhana,* and *Vata-Pitta Shamana*, thereby improving microcirculatory flow and reducing ischemic changes. The anticoagulant and anti-inflammatory peptides present in leech saliva such as hirudin, calin, and eglins enhance local blood flow, relieve congestion, and promote oxygenation to the ischemic nerves. [59,60] These actions correspond with modern evidence demonstrating that leech therapy improves tissue perfusion, reduces oxidative stress, and alleviates neuropathic pain in diabetic patients. [61,62] Additional supportive measures like *Abhyanga, Swedana, Basti* and *Rasayana* therapy (e.g., *Ashwagandha, Bala, Guduchi*) further assist in *Dhatu Poshana* (~tissue nourishment) and regeneration of degenerated nerve fibers. [63,64] Together, these *Ayurvedic* modalities aim to restore arterial flow through *Adhodhamani*, normalize *Rasavahini Srotas*, and thereby promote the nutrition and functional recovery of peripheral nerves in diabetic neuropathy.

However, limitations include heterogeneous study designs, small sample sizes and lack of standardized outcome measures. Future studies should employ robust RCT designs with validated scales (VAS, Neuropathy Symptom Score, Nerve Conduction Studies).

Conclusion

DPN is a debilitating complication of diabetes with limited therapeutic options in biomedicine. Ayurveda provides a holistic understanding of DPN as an *Upadrava* of *Madhumeha*. An integrative management strategy involving *Ayurvedic Shodhana* and *Shamana Chikitsa* shows promising improving in patient outcomes. *Shamana Chikitsa* act as a primary mode of care. The approach of *Shamana Chikitsa* helps to enhance the overall health of the body. Thus *Ayurveda* provides both preventive and therapeutic models for management of DPN and improve the quality of life of patients in elder age. Further large-scale trials and mechanistic studies are essential to

establish the evidence-based guidelines in management of DPN through holistic Ayurveda approach.

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