International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Devdaru–Manjishthadi Kwatha: An Evidence-Based Review of Phytoconstituents for Diabetes Control

Vd. Bhagyshree G. Gadewar[1], Vd. Raman S. Belge[2]

[1]M.D. Scholar, Department of Rasashastra and Bhaishajya Kalpana, Shri Ayurved Mahavidyalaya, Nagpur
[2]Professor & H.O.D. Department of Rasashastra and Bhaishajya Kalpana, Shri Ayurved Mahavidyalaya, Nagpur.

ABSTRACT
Diabetes Mellitus (Madhumeha) is a complex and rapidly growing global health challenge, projected to affect 853 million adults by 2050. Ayurveda views Madhumeha as a systemic metabolic disorder involving multiple Doshas and tissues, providing a framework for complementary approaches to care. This review presents an evidence-based rationale for a proposed polyherbal decoction, Devdaru–Manjishthadi Kwatha, combining four potent Ayurvedic herbs: Devdaru (*Cedrus deodara*), Manjishtha (*Rubia cordifolia*), Bala (*Sida cordifolia*), and Gokshura (*Tribulus terrestris*). Each herb was selected based on its classical relevance in managing metabolic imbalances and contemporary pharmacological evidence relevant to diabetes.
Individually, these herbs demonstrate significant antidiabetic and antioxidant properties. *C. deodara* extract exhibits glucose-lowering effects and contains potent antioxidant lignans. *R. cordifolia* reduces blood glucose in diabetic models and inhibits lipid peroxidation. *S. cordifolia*, traditionally Ojovardhak (Ojas-enhancing), improves diabetic neuropathy and shows antihyperglycemic activity. *T. terrestris* lowers serum glucose and triglycerides, partly via steroidal saponins, and inhibits gluconeogenesis. Collectively, these data suggest that this proposed combination offers a scientifically rational, multi-targeted approach to addressing the diverse pathological factors of Madhumeha.

Keywords: Devdaru–Manjishthadi Kwatha, Madhumeha, Polyherbal Formulation, Cedrus deodara, Rubia cordifolia, Sida cordifolia, Tribulus terrestris, Antidiabetic, Evidence-Based Ayurveda.

Introduction

Diabetes mellitus is a major global health concern, affecting 589 million adults in 2024, with projections reaching 853 million by 2050. Most cases (81%) occur in low- and middle-income countries, and nearly 43% remain undiagnosed. The disease caused 3.4 million deaths in 2024 and incurred over USD 1 trillion in global healthcare costs. In South-East Asia, cases are expected to rise from 107 million in 2024 to 185 million by 2050, underscoring the urgent need for effective and accessible diabetes management strategies(1).
Although a wide range of modern treatments is available insulin preparations, various oral antidiabetic drugs, and combination therapies patients often face difficulties that are not always reflected in clinical

recommendations. Medicine costs can be heavy, some drugs bring unwanted side effects, and keeping sugar levels under control day after day remains a real challenge for many(2). Because of these everyday limitations, interest in traditional medical approaches has grown steadily. Ayurveda, which emphasizes restoring metabolic balance rather than focusing only on blood glucose numbers, is increasingly viewed as a complementary path worth considering for long-term diabetes care.

Madhumeha is understood in Ayurveda as a metabolic disorder influenced by an individual's constitution and hereditary factors. It is listed among the twenty forms of *Prameha* and is categorized specifically under *Vatika Prameha*, where the affected person passes large quantities of urine that resembles and tastes like honey(3,4). This description reflects the classical Ayurvedic view of the condition as a systemic imbalance rather than a single-organ disease.

Although *Madhumeha* is classified under *Vataja Prameha*, it is far more common in the population and is closely aligned with what modern medicine identifies as diabetes mellitus. The condition is described as one in which the urine acquires qualities similar to honey *Kashaya* and *Madhura* in taste, *ruksha* (dry) in nature, and honey-like in appearance(5). Its pathogenesis involves the interplay of Vata, Pitta, Kapha, Meda, and Oja, highlighting its multifactorial nature(6). Treatment, therefore, focuses on Tridosha-shamana, supported by *Brimhana*, *Karshana*, and *Rasayana* therapies to restore systemic balance(7).

Acharya Sushruta notes that all forms of *Prameha*, if neglected in the early stages, eventually progress to *Madhumeha*(8). Charaka further describes the urine of a *Madhumeha* patient as having *Kashaya* and *Madhura rasa*, a pale coloration, and a distinct dryness in quality(9). Gangadhar interprets this as a displacement of the natural sweetness of *Oja* by astringency within the bladder, while Chakrapani attributes this transformation to the specific action of *Vayu*, which converts the sweet essence of *Oja* into a *Kashaya* quality(10).

The depletion of *Oja* leads to weakness, sensory disturbances, and a decline in both physical and mental strength. Excessive intake of heavy, sweet, and cold foods increases *Kapha*, resulting in frequent and cloudy urination. To expel the disturbed *Oja* from the bladder, the body demands more fluid, giving rise to *trishnadhikya* (polydipsia). The honey-like character of the urine in *Madhumeha* is consistently noted across classical texts including *Sushruta Samhita*(11), *Ashtanga Sangraha*(12), *Ashtanga Hridaya*(13) and *Madhava Nidana*(14).

Management in this tradition emphasizes a combination of dietary modifications, lifestyle interventions, and herbal formulations. Among these, *Devdaru–Manjishthadi Kwatha* has been traditionally valued for its effects on metabolic regulation, detoxification, and circulation. Its principal herbs *Devdaru* (Cedrus deodara), *Manjishtha* (Rubia cordifolia), *Bala* (Sida cordifolia), and *Gokshura* (Tribulus terrestris) have historical and textual significance in supporting tissue health and maintaining internal balance.

Modern research supports these traditional insights, showing that the bioactive constituents of these herbs can influence multiple pathways relevant to diabetes management. Studies suggest they may enhance insulin sensitivity, improve glucose uptake, reduce inflammation, and protect against oxidative stress. By combining these herbs in a decoction like *Devdaru–Manjishthadi Kwatha*, the formulation potentially leverages synergistic effects, making it a promising candidate for integrative and complementary approaches in diabetes care. This review systematically evaluates the scientific evidence behind these key ingredients, aiming to bridge classical Ayurvedic knowledge with contemporary biomedical research.

Review of literature:

1. Devdaru

Devdaru (Cedrus deodara), revered in Ayurveda as the "Tree of the Gods," is recognized for its remarkable therapeutic potential. Ancient texts such as the *Charaka Samhita* and *Sushruta Samhita* describe it as a powerful remedy, particularly useful in conditions caused by imbalances in *Vata* and *Kapha doshas*(15). Its bitter and astringent taste, along with a warming energy, makes it effective for supporting joint health, reducing inflammation, alleviating respiratory issues, and managing certain skin disorders. Classical Ayurvedic literature emphasizes the versatile therapeutic value of *Devadaru.* Beyond its external uses, such as reducing swelling and relieving joint pain(16), it is also recommended internally for conditions like *Vata-vyadhi*, *Kasa* (cough), *Shwasa* (asthma), and *Jwara* (fevers)(17). These texts underscore *Devadaru's* ability to restore balance within the body, cleanse the tissues, and eliminate *Ama* (metabolic toxins), reflecting its role in supporting both systemic health and targeted disease management(18).
Traditionally, *Devdaru* has been valued not only for symptom relief but also for its role in restoring overall metabolic and tissue balance, reflecting Ayurveda's holistic approach to healing.

Phytochemicals of *Cedrus deodara*(19–22)

Phytochemical Group	**Major Constituents**
Essential Oils	Cedrol, Cedrene, Cedral
Flavonoids	Quercetin, Kaempferol
Tannins	Catechins
Alkaloids / Flavonoid-like Compounds	Apigenin
Terpenoids	α-Cedrene, β-Cedrene
Saponins	Saponin Glycosides
Phenolic Compounds	Phenolic Acids

Pharmacological Activities:

1. Anti-diabetic Activity(23)**:**

Ethanolic extract of *Cedrus deodara* wood, obtained after defatting with petroleum ether, demonstrated the presence of key phytochemical groups such as glycosides, tannins, flavonoids, fixed oils, and triterpenoids. Preformulation studies were carried out to assess the extract's compatibility with various excipients. Among the tested formulations, only PF3 containing microcrystalline cellulose yielded pharmaceutically acceptable granules and exhibited favorable in-vitro drug release (approximately 80.5%).
The optimized capsule formulation (F3) showed superior physicochemical stability and consistent drug release compared to other prototypes. Subsequent in vivo evaluations, including acute toxicity and antidiabetic assays, indicated that the formulation was safe and produced significant glucose-lowering effects, underscoring the therapeutic potential of *C. deodara* wood extract in diabetes management.

2. Antioxidant Activity(24)**:**

The nervous system is particularly prone to oxidative injury, and *Cedrus deodara* has shown significant antioxidant potential. Chloroform extract of its defatted heartwood displayed strong DPPH radical-scavenging activity. Subsequent chromatographic separation yielded three major antioxidant lignans (–)-matairesinol, (–)-nortrachelogenin, and a dibenzylbutyrolactol derivative confirmed through spectroscopic analysis. These compounds underline the plant's capacity to neutralize free radicals.

3. Manjishtha:

Manjistha is widely mentioned across the Ayurvedic classics for its utility in blood purification, inflammation, skin disorders and metabolic diseases, including *Prameha*. In *Charaka Samhita*(25) and *Sushruta Samhita*(26) it is listed under Varnya, Vishaghna and Pittasamshamana groups, indicating its role in disorders involving doṣha–duṣhya vitiation. *Ashtanga Hridaya*(27) and Chakrapani(28) also highlight its use in Jwara, Daha and Vrana conditions closely linked with Pitta-Kapha imbalance seen in Prameha. The *Laghutrayi*, especially *Sharangadhara Samhita*(29) and *Bhavaprakasha Samhita*(30), describe Manjistha in multiple formulations for Kushta, Shotha and Vrana, reflecting its strong Raktaprasadana and Medohara effects relevant to Prameha pathology. Later compendia including *Vangasena Samhita*(31) and major Nighantus *Bhavaprakasha*(32), *Dhanvantari*(33), *Raja*(34), *Kaiyadeva*(35) and *Shaligram Nighantu*(36) explicitly mention Manjistha as beneficial in *Prameha*, owing to its actions on Rakta, Meda and Mutravaha strotas.

Phytochemical constituents of Rubia cordifolia(37,38)

Phytochemical Group	Major Constituents
Anthraquinones & Glycosides	Anthraquinones, anthraquinone glycosides, alizarin, pseudopurpurin, rubiadin, purpurin (trihydroxyanthraquinone), manjistin (xanthopurpurin-2-carboxylic acid), xanthopurpurin, purpuroxanthin, dihydromollugin, mollugin, rubilactone; additional anthraquinones: 1-hydroxy-2-methoxy anthraquinone, 1,4-dihydroxy-2-methyl-5-methoxy anthraquinone, 1,3-dimethoxy-2-carboxyanthraquinone
Naphthoquinones & Derivatives	Naphthoquinone derivatives; napthlene derivatives
Terpenes / Triterpenoids	Oleanane triterpenoids: rubiprasin A, B, C; arborane triterpenoids: rubiarbonol A–F; oleanolic acid acetate
Bicyclic Hexapeptides	Hexapeptides with reported antitumour activity
Iridoids	6-methoxygeniposidic acid, manjistin, garancin, alizarin (also an anthraquinone)
Carboxylic Acids	Malic, citric, quinic, rosmarinic acids
Saccharides	Xylose, ribose, fructose, glucose, sucrose, primverose
Saponins	Various saponins isolated from roots
Other Compounds	β-sitosterol, scopoletol, ten long-chain saturated and unsaturated fatty acids
	Purpurin acts as a fast dye, binds glycosaminoglycans and retinol, and forms complexes with metal ions; Alizarin (1,2-dihydroxyanthraquinone) historically important natural red dye

Therapeutic uses of Rubia cordifolia (Manjishtha)

1. **Antidiabetic:** The alcoholic extract of *Rubia cordifolia* has shown significant antidiabetic activity, as demonstrated in an alloxan-induced diabetic rat model. In this study, administration of the extract led to a marked reduction in blood glucose levels, indicating its potential for glycemic control(39).
2. **Anti-oxidant:** The antioxidant potential of *Rubia cordifolia* has been supported by multiple in-vivo studies. In Swiss male albino rats, lead nitrate exposure caused reductions in RBC and WBC counts,

hemoglobin, and serum total protein, whereas treatment with the plant's alcoholic root extract improved these hematological and biochemical parameters, demonstrating protective activity(40). Another study using $FeSO_4$-induced lipid peroxidation in rats showed that both the alcoholic extract and rubiadin effectively inhibited lipid peroxidation, further confirming the plant's antioxidant properties(41).

3. **Bala:** Vedic literature describes Bala for its Rasayana, Vishaghna, Balya, and Pramehaghna actions. Charaka includes it in Balya, Brimhaniya, and Prajasthapana Mahakashaya, calling it *Sangrahik Balya Vataharanam* and grouping it under Madhur Skandha (42–44). Sushruta places Bala in Vata Samshamana and Madhur Varga, recommending *Bala Taila* for *Sadya Kshata Vrana* and *Anuvasana Basti* in *Pakshaghat*(45). Vagbhata lists it in Madhyam Panchamoola(46). Dhanwantari Nighantu describes Bala as Vrishya, Balya, Tridosha Nashak, with Madhur Rasa and Sheet Virya (47). Hridaya Deepak includes it in Doshaghna Varga(48), while Kaiyadeva notes its fruits as Stambhak, Lekhana, Raktavikar Nashak, and Vata-Pitta Shamak(49). Nighantu Adarsha identifies it as Grahi, Vrishya, Ojovardhak under Karpasadi Varga(50), and Maha Aushadh Nighantu highlights its role in enhancing taste and supporting strength (51).

Phytochemical Constituents of *Sida cordifolia*(52,53)

Phytochemical Group	**Major Constituents**
Major Phytochemicals	Ephedrine, pseudoephedrine, sterculic acid, malvalic acid, coronaric acid, fatty acids, saponins, β-phenethylamine, hypaphorine, ecdysterone, indole alkaloids, palmitic acid, stearic acid, β-sitosterol
Alkaloid Content	Total alkaloids in whole plant: 0.085% (seeds contain the highest amount)
Identified Alkaloids	Ephedrine and other alkaloids
Seed Constituents	Fatty oil (3.23%), steroids, phytosterol, resin, resin acids, mucin, potassium nitrate

Therapeutic uses of Bala (Sida cordifolia)

1. **Anti-diabetic activity:** Acharya Charaka recommends Santarpan Chikitsa for Madhumeha, emphasizing nourishment of depleted tissues. Since Bala is described as Balya and Ojovardhak, it aligns with the management of Madhumeha, also known as Ojomeha. By enhancing Ojas, Bala is considered beneficial for this condition. This classical view is supported by experimental evidence, as root extracts of *S. cordifolia* have shown anti-diabetic activity by significantly reducing blood glucose levels in rats(54).
2. **Anti-oxidant activity:** Acharya Charaka and Acharya Sushruta describe Bala as a Rasayana, highlighting its rejuvenating and protective qualities (55). This traditional view is supported by studies on its role in neurodegenerative disorders. In an experimental evaluation, *S. cordifolia*, along with *Cynodon dactylon* and *Evolvulus alsinoides*, demonstrated significant antioxidant activity, shown through ABTS radical cation decolorization and inhibition of lipid peroxidation in rat brain homogenate (56).
3. **Diabetic Neuropathy:** The effect of Bala on diabetic neuropathy was clinically evaluated in confirmed cases attending a diabetic clinic. Using newly adopted physiological assessment methods,

the study demonstrated that *S. cordifolia* significantly improved symptoms, confirming its therapeutic value in managing diabetic neuropathy (57).

4. **Gokshur:** Gokshura (*Tribulus terrestris*) is widely celebrated in Ayurvedic literature for its versatile therapeutic actions. Classical texts consistently describe it as a potent diuretic, Vata-pacifying, and rejuvenating herb. Charaka Samhita notes its benefits in urinary disorders, edema, and worm infestations, and even recommends Gokshura-boiled milk for bleeding conditions(58). Sushruta Samhita classifies it in several important groups such as Vidarigandhadi Gana, Laghu Panchamula, and Kantaka Panchamula reflecting its broad therapeutic value(59). Ashtanga Hridaya highlights its role in dysuria and Rasayana formulations(60). Medieval texts further expand its applications. Bhavaprakasha describes preparations for dysuria, gravel, urolithiasis, and urinary discomfort using seeds or whole herb combinations(61). Amarakosha lists Gokshura under Vanaoushadhi Varga, underscoring its botanical significance(62). In Vrindamadhava, formulations for bleeding, urinary disorders, and aphrodisiac purposes are described in detail(63,64). A wide range of Nighantus from Dhanvantari to Shankara Nighantu document Gokshura's synonyms, pharmacological properties, and dosha-specific actions, repeatedly identifying it as Vatahara, Mutrala, Vrishya, Balya, and Tridoshahara(65–74). These texts collectively affirm Gokshura's importance in classical Ayurvedic therapeutics, especially for urinary, reproductive, and systemic health.

Phytochemical Constituents of Tribulus terrestris:

Phytochemical Group	**Major Constituents**
Alkaloids(75)	Tribulusin A, Tribulusamide C, Tribulusterine, Terrestriamide, Harman, Harmine, Harmmol, *N*-trans-caffeoyltyramine, *N*-trans-coumaroyltyramine
Flavonoids(76)	Kaempferol, Isorhamnetin, Quercetin
Amino Acids(77)	Alanine, Threonine
Saponins(78)	108 types of steroidal saponins: 58 Spirostanol-type, 50 Furostanol-type
Organic Acids(79)	Benzoic acid, Vanillic acid, 2-methyl benzoic acid, Ferulic acid, Succinic acid, Palmitic acid

Therapeutic uses of Gokshur (Tribulus terrestris)

1. **Antidiabetic activity:**

a. Tribulus terrestris shows notable antidiabetic effects, largely attributed to its saponin content(80). Studies report that it lowers serum glucose, triglycerides, and cholesterol, while increasing serum superoxide dismutase (SOD) levels in alloxan-induced diabetic mice. Additionally, a decoction of T. terrestris has been shown to inhibit gluconeogenesis in experimental models(81).

2. **Antioxidant activity:**

a. The drug exhibits antioxidant activity, as demonstrated through both DPPH and FRAP assays(82).

Discussion:

Ayurvedic management of Madhumeha emphasizes Tridosha balance and restorative therapies like Rasayana. The proposed Devdaru–Manjishthadi Kwatha is a rational combination designed to target the multifactorial nature of diabetes, drawing on the scientifically validated properties of its four selected herbs.

Devdaru (*Cedrus deodara*): Traditionally used to pacify Vata and Kapha and eliminate Ama (toxins), it demonstrates potent glucose-lowering activity in ethanolic wood extracts and strong antioxidant effects. These properties help mitigate systemic inflammation and metabolic toxicity.
Manjishtha (*Rubia cordifolia*): Classically indicated for blood purification (Raktaprasadana), Medohara (fat-reducing) effects, and Pitta-Kapha imbalances, it shows antihyperglycemic activity in diabetic models and strong antioxidant potential, addressing derangements in Rakta (blood) and Meda (fat tissues).
Bala (*Sida cordifolia*): Recognized as Balya and Ojovardhak, it restores vital essence (Ojas) depleted in Madhumeha (Ojomeha), alleviating weakness and sensory disturbances. Experimental studies confirm its antidiabetic effects and benefit in diabetic neuropathy.
Gokshura (*Tribulus terrestris*): Known for diuretic (Mutrala) and Vata-pacifying effects, it supports urinary health in Prameha. Its steroidal saponins contribute to reduced serum glucose and lipids and suppression of gluconeogenesis.
Together, these herbs create a synergistic therapeutic profile targeting key aspects of Madhumeha: 1) glucose and lipid control (*Devdaru, Manjishtha, Gokshura*); 2) protection against oxidative stress (*Devdaru, Manjishtha, Bala, Gokshura*); and 3) restoration of vital strength and nervous system health (*Bala, Gokshura*). This approach integrates classical Ayurvedic principles with modern pharmacological evidence, offering a comprehensive complementary strategy for diabetes management.

Conclusion:

The proposed *Devdaru–Manjishthadi Kwatha* represents a scientifically rational polyherbal formulation for the complementary management of Diabetes Mellitus (Madhumeha). Although this specific combination is not described in classical texts, its constituent herbs—Devdaru, Manjishtha, Bala, and Gokshura—have established roles in Ayurveda for modulating metabolic, circulatory, and nervous system functions. Modern pharmacological studies further support their antidiabetic, antioxidant, and tissue-protective effects. By targeting multiple pathways involved in Madhumeha pathogenesis, this formulation may offer enhanced therapeutic benefits compared to single-herb interventions. Future clinical studies are warranted to evaluate its efficacy, safety, and potential role in integrative diabetes care.

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