



Pharmacological review of Darvyadi Kashaya in the management of Prameha and Diabetes Mellitus

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Diabetes Mellitus (DM), a global metabolic disorder, is characterized by chronic hyperglycemia due to insulin resistance or deficiency. Ayurveda correlates this condition with Prameha. Darvyadi Kashaya, a classical Ayurvedic polyherbal formulation mentioned in Charaka Samhita, has traditionally been used in the management of Prameha. It comprises potent herbs like Daruharidra (*Berberis aristata*), Devadaru (*Cedrus deodara*), Vibhitaki (*Terminalia bellirica*), Haritaki (*Terminalia chebula*), Amalaki (*Embolica officinalis*), and Mustaka (*Cyperus rotundus*), each known for their Kapha-Pitta Shamaka, Medohara, Deepana, and Pramehaghna actions. This review integrates Ayurvedic textual references and modern pharmacological evidence to evaluate the antidiabetic potential of Darvyadi Kashaya.

Keywords: Darvyadi Kashaya, Diabetes, Prameha

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Introduction

Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia, resulting from impaired insulin secretion, insulin action, or both. It is a major global health concern, associated with long-term complications affecting the eyes, kidneys, nerves, and cardiovascular system. Despite the availability of various oral hypoglycemic agents and insulin therapies, their limitations, such as adverse effects, cost, and long-term dependency, highlight the need for safer and more holistic alternatives. In *Ayurveda*, Diabetes Mellitus can be correlated with *Prameha*, a group of metabolic-urinary disorders described in detail in the *Brihatrayi*. Cardinal features of *Prameha* are *Prabhuta Mutrata* (polyuria) & *Avila Mutrata* (turbid urine).[1] *Ayurveda* emphasizes the multifactorial etiology of *Prameha*, including sedentary lifestyle, excessive intake of guru-Snigdha Ahara (heavy, unctuous diet), & hereditary predisposition, resulting in *Kapha-Medovaha Srotodushti* & *Agnimandya*, which lead to derangement of metabolism.[2] *Darvyadi Kashaya* is classical polyherbal formulation mentioned in *Charaka Samhita* for the management of *Prameha*. It contains well-known medicinal herbs such as *Daruharidra* (*Berberis aristata*), *Devadaru* (*Cedrus deodara*), *Vibhitaki* (*Terminalia bellirica*), *Haritaki* (*Terminalia chebula*), *Amalaki* (*Emblica officinalis*), and *Mustaka* (*Cyperus rotundus*).[3]

These herbs collectively exhibit *Kapha-Pitta Shamaka*, *Medohara*, *Deepana*, *Pachana*, *Mutrala*, *Raktaprasadana*, and *Pramehaghna* properties, which are essential for addressing root pathology of *Prameha*. [4] Contemporary pharmacological studies have validated the antidiabetic potential of these ingredients. This review aims to present a comprehensive pharmacological evaluation of *Darvyadi Kashaya* in the management of *Prameha* and Diabetes Mellitus by correlating traditional *Ayurvedic* concepts with modern scientific evidence, thereby establishing its relevance as a safe and effective option in integrative diabetic care.

Objective

To review *Pramehaghna* and Antidiabetic properties of *Darvyadi Kashaya* contents.

Scientific review of Darvyadi Kashaya

A. Review from Ayurveda Literature [5,6,7]

The *Rasa Panchaka* (i.e., *Rasa*, *Guna*, *Virya*, *Vipaka*, and *Prabhava*) and principal pharmacological actions of the individual ingredients of *Darvyadi Kashaya* are outlined [Table 1]. These properties collectively contribute to its therapeutic relevance in management of *Prameha* by targeting predominant *Dosha*, correcting metabolic dysfunction, and addressing the underlying *Dosha-Dushya Sammurchana* involved in the pathogenesis of diabetes mellitus.

Table 1: Properties of ingredients of Darvyadi Kashaya

SN	Drug name	Useful part	Rasa	Guna	Virya	Vipak	Action
1.	Daruharidra (Berberis aristata)	Stem, bark, fruit, root, wood	Tikta, Kashaya	Laghu, Ruksha	Ushna	Katu	Kapha- Pitta Shamaka, Shothahara, Vedanasthapana, Vranashodhana, Vranaropana, Chakshushya, Deepana, Yakriduttejaka, Pittasaraka, Grahi (Phala Rochana, Trishnanigraha), Raktashodhaka, Raktastambhana (Rasanjana), Kaphaghna, Swedajanana, Varnya, Jwaraghna, Vishmajwarapratibandhaka
2.	Devadaru (Cedrus deodara)	Heartwood, oil, leaf, bark, resin	Tikta	Laghu, Snigdha	Ushna	Katu	KaphaPitta Shamaka, Shothahara, Vedanasthapana, Kushthaghna, Krimighna. Vranashodhana, Vranaropana, Deepana, Pachana, Anulomana, Hridyottejaka, Raktaprasadana, Kaphanissaraka, Hikkanihgrahan, Motrajanana, Pramehaghna, Garbhashayashodhana, Stanyashodhana
3.	Vibhitaki (Terminalia bellirica)	Fruit, seed, bark	Kashaya	Laghu, Ruksha	Ushna	Madhura	Tridosha Shamaka especially Kapha Shamaka, Shothahara, Vedanasthapana, Raktastambhana, Krishnikurana, Madaka, Deepana, Anulomana, Krimighna, Rechana, Bhedana, Grahi, Trishnanigrahana, Chhardinigrhana, Kaphaghna, Vajikarana, Dhatuvardhaka Chakshushya
4.	Haritaki (Terminalia chebula)	Fruit	Kashaya, Tikta, Madhura, Katu, Amla	Laghu, Ruksha	Ushna	Madhura	Tridoshashamak (Visheshta Vata Shamaka) Shothahara, Vedanasthapana, Vranashodhana, Vranaropana, Nadibalya, Medhya, Chakshushya, Deepana, Pachana, Yakriduttejaka, Anulomana, Mridurechana, Krimighna, Grahi, Shonitasthapana, Hridya, Kaphaghna, Srotah-shodhana, Vrishya, Garbhashayashothahara, Prajasthapana, Mootrala, Kushthaghna, Rasayana

SN	Drug name	Useful part	Rasa	Guna	Virya	Vipak	Action
5.	Amalaki (Embllica officinalis)	Root bark, stem bark, kaf, fruit, seed	Amla, Madhura, Kashaya, Tikta, katu Ruksha,	Guru,	Sheeta	Madhura	Tridosha Shamaka, especially Pitta Shamaka, Karma Dahaprashmana, Chakshushya, Keshya, Medhya, Nadibalya, Balya Rochana, Deepana, Anulomana, Amlatanashaka, Yakriduttejaka, Stambhuma Sransana, Hridya Shonitasthapana, Kaphaghna, Vrishya
6.	Mustaka (Cyperus rotundus)	Tuber	Tikta, Katu, Kashaya	Laghu, RSheeta	Katu		Kapha Pitta Shamaka, Twagdosahara, Shothahara, Lekhana, Stanyajanana, Medhya, Nadibalya, Deepana, Pachana Grahi, Trishnanigrahana Krimighna, Sangrahaka, Raktaprasadana, Kaphaghna, Mutrala, Garbhashayasankochaka, Stanyajanana, Stanyashodhana, Jwarghna, Balya, Vishaghna

Method of preparation: The decoction (*Kwath*) of *Darvyadi* group of drugs is prepared by boiling the coarse powder of the ingredients with eight times the quantity of water. The mixture then reduced to one-eighth of its original volume through continuous heating.

B. Antidiabetic properties of Darvyadi Kashaya

1. Daruharidra (*Berberis aristata*)

Berberis aristata (BA), widely known as Indian barberry, contains berberine, a potent alkaloid recognized for its antidiabetic effects. Berberine contributes to glycemic control by enhancing insulin sensitivity, stimulating glucose uptake in peripheral tissues, and inhibiting hepatic gluconeogenesis, thereby improving overall glucose metabolism.[8,9] An experimental study assessed the antidiabetic potential of *Berberis aristata* (BA) and *Withania somnifera* (WS) in STZ-NIC-induced diabetic Wistar rats. BA, rich in berberine, demonstrated significant hypoglycemic activity through enhanced insulin sensitivity, glucose uptake, and inhibition of hepatic gluconeogenesis, primarily via AMPK activation.[10] Another study also demonstrate that *Daruharidradi Ghana Vati* significantly reduces the blood sugar level and shows anti-diabetic effect in streptozocin induced diabetic wistar rats.[11]

Another study shows, *Berberis aristata* lowers blood glucose in alloxan induced diabetic rats, restore antioxidant status, reduce oxidative stress, hepato-protection and modulate enzymes responsible for glucose metabolism. This study confirms antihyperglycemic and strong antioxidative properties of *Berberis aristata* root extract in diabetic rats.[12]

2. Devadaru (*Cedrus deodara*)

The antidiabetic and antioxidant potential of *Cedrus deodara* was demonstrated in a study involving alloxan-induced diabetic rats, where oral administration of its aqueous extract resulted in a significant reduction in blood glucose levels.

The extract also significantly attenuated oxidative stress, as evidenced by a marked reduction in hepatic lipid peroxidation and significant increases in the activity of antioxidant enzymes - Glutathione, Catalase, Superoxide Dismutase, and Glutathione-S-Transferase - in liver, kidney, and pancreatic tissues. These findings indicate that *Cedrus deodara* extract exerts both antihyperglycemic and antioxidative effects, mitigating the oxidative damage caused by alloxan.[13] *Cedrus deodara* is known to contain a variety of bioactive constituents, including sterols, polyphenols, flavonoids (such as taxifolin and quercetin), and saponins.[14] Saponins have been reported to be effective in managing obesity,[15] phytosterols are known for their hypolipidemic effects[16], while polyphenols and flavonoids exhibit potent antioxidant activity. These phytoconstituents are likely contributors to the observed glucose- and lipid-lowering effects of *C. deodara*. [17] Furthermore, treatment with *C. deodara* extracts significantly reduced the weight of various internal organs in monosodium glutamate (MSG)-induced obese rats, indicating a potential role in reducing adipose tissue accumulation.[18]

3. Vibhitaki (*Terminalia bellirica*)

A study demonstrated that *Terminalia bellerica* stimulates both insulin secretion and action. The aqueous extract of *T. bellerica* significantly increased insulin release from BRIN-BD11 pancreatic β -cells in a dose-dependent manner, irrespective of glucose presence, without causing cellular leakage. Additionally, the extract exhibited insulin-mimetic properties, enhancing insulin-stimulated glucose uptake in 3T3-L1 adipocytes.[19]

These findings are further supported by another study conducted by Latha and Daisy, which investigated the insulin secretagogue and antihyperlipidaemic effects of gallic acid, a bioactive compound isolated from *Terminalia bellerica*, in streptozotocin-induced diabetic rats.

Oral administration of gallic acid significantly reduced plasma glucose levels, achieving values comparable to those of normal control group. Additionally, gallic acid increased plasma insulin and C-peptide levels by 62.92% and 79.74%, respectively. Histopathological analysis revealed restoration of normal pancreatic islet cell architecture and a notable reduction in cellular vacuolation.[20]

4. Haritaki (*Terminalia chebula*)

An aqueous extract of *T. chebula* was evaluated for its antidiabetic activity. Past studies have shown that extracts of *T. chebula*, including ethanolic and chloroform preparations, exerted hypoglycaemic effects in both type 1 and type 2 diabetic animal models, often by enhancing antioxidant enzyme levels and reducing blood glucose and lipid levels.[21,22]

In this study[23], *T. chebula* aqueous extract significantly prevented pancreatic β -cell damage and enhanced insulin sensitivity, improved outcomes in oral glucose tolerance test (OGTT), significantly lowering plasma glucose and insulin levels, improved insulin sensitivity index (ISI) and reduced HOMA-IR, indicating better glucose utilization, normalized lipid profile by lowering LDL, cholesterol, triglycerides & increasing HDL, thereby addressing dyslipidaemia[24,25,26], Reduced hepatic injury markers ALT and AST, suggesting hepatic protection.[27,28]

T. chebula also decreased HbA1c (glycohemoglobin) levels, which were elevated due to persistent hyperglycemia in diabetic rats.[29,30] Furthermore, it enhanced antioxidant enzyme levels such as GSH, CAT, and SOD, providing protection against oxidative stress-induced pancreatic damage.[31] These enzymes prevent damage from H₂O₂, alkoxy radicals, and superoxide. Histological analysis confirmed less pancreatic tissue damage, showing reduced inflammation, necrosis, atrophy, and lymphocytic infiltration in *T. chebula* treated groups.

The study also demonstrated that *T. chebula* upregulated SIRT1, a NAD⁺-dependent histone deacetylase involved in glucose homeostasis, lipid metabolism, insulin sensitivity, and hepatic glucose production. SIRT1 also prevents fibrosis of pancreatic tissue in diabetes, and its expression was restored upon treatment, suggesting a novel protective mechanism of *T. chebula* in T2DM.[32]

5. Amalaki (*Emblica officinalis*)

Chronic exposure to low levels of arsenic is linked to the development of type 2 diabetes mellitus (T2DM) by impairing insulin signaling, causing insulin resistance, and triggering oxidative stress and mitochondrial dysfunction.[33,34] Study investigated the protective effect of *Emblica officinalis* (*Amla*) against arsenic-induced hyperglycemia in mice. Co-treatment with *Amalaki* normalized blood glucose, restored insulin and C-peptide levels, corrected hepatic glucose-regulating enzymes, and improved electrolyte balance. These effects are attributed to its hypoglycemic and antioxidant properties, suggesting its potential as a natural therapeutic agent in arsenic-induced metabolic disorders.[35] Hydro-methanolic extract of *Emblica officinalis* leaves (HMELEO) was evaluated for its hypoglycemic & antioxidant effects in streptozotocin-induced diabetic rats. Oral administration of the extract significantly reduced blood glucose levels, improved insulin secretion, and normalized liver and kidney function markers. It also enhanced antioxidant enzyme levels and reduced lipid peroxidation. The results suggest that *E. officinalis* leaf extract effectively manages diabetes and oxidative stress, showing potential as a natural therapeutic agent.[36]

6. Mustaka (*Cyperus rotundus*)

In support of its traditional use in managing diabetes, a study conducted on alloxan-induced diabetic rats demonstrated that the hydro-ethanolic extract of *Cyperus rotundus* significantly reduced blood glucose levels. This activity is likely linked to the extract's potent antioxidant properties, as evidenced by its strong DPPH radical scavenging activity observed in vitro.[37]

Another study reported that ethanolic extract of *Cyperus rotundus* rhizomes exhibited significant antidiabetic effects in streptozotocin-induced diabetic mice. The treatment not only led to a notable reduction in blood glucose levels but also improved body weight and normalized elevated biochemical parameters, including SGPT, SGOT, cholesterol, and triglycerides, indicating a comprehensive metabolic benefit.[38]

The rhizome of *Cyperus rotundus* has demonstrated significant antidiabetic potential in various in vitro and in vivo studies.

The 70% ethanolic extract of the rhizome exhibit antioxidant activity through radical scavenging and notable anticholinesterase inhibitory activity.[39]

In vivo, oral administration of the same 70% ethanolic extract in experimental animal models resulted in a significant reduction in blood glucose levels (BGLs), supporting its role as a promising antihyperglycemic agent.[40]

Further, four bioactive compounds were isolated from the methanolic extract—namely, (2RS, 3SR)-3,4',5,6,7,8-hexahydroxyflavane, cassigarol E, scirpusin A, and scirpusin B. These compounds demonstrated strong inhibitory activity against the carbohydrate-hydrolyzing enzymes α -glucosidase and α -amylase, essential targets for controlling postprandial hyperglycemia.[41]

Moreover, treatment with the extract led to improvements in metabolic markers, including body weight, serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), and lipid profiles, indicating systemic metabolic benefits beyond glycemic control.[42]

In additional pharmacological assessments, aqueous extracts of *C. rotundus* effectively inhibited intestinal glucose absorption and enhanced glucose uptake in muscle tissue, mimicking insulin-like activity.[43] These results reinforce the multifaceted mechanism through which *Cyperus rotundus* exerts its antidiabetic effects, encompassing enzyme inhibition, enhancement of peripheral glucose utilization, and regulation of metabolic parameters.

A study on *Drosophila* showed that *C. rotundus* kombucha significantly reduced α -glucosidase activity and improved antioxidant enzyme activity when supplemented in a high-sugar diet.[44]

Discussion

Darvyadi Kashaya is a polyherbal Ayurvedic formulation with potent *Pramehaghna* (antidiabetic) action, attributed to its ingredients that align both Ayurvedic principles and modern pharmacological mechanisms in the management of *Prameha* and diabetes mellitus. In *Ayurveda*, *Prameha* is characterized by *Kleda Vriddhi* (increased bodily moisture), *Meda Dhatu Dushti* (vitiation of fat tissue), and aggravated *Kapha* and *Pitta Doshas*, leading to excessive urination, deranged metabolism, and loss of *Oja*.

The herbs in *Darvyadi Kashaya* possess properties that specifically address these pathologies. *Daruharidra* (*Berberis aristata*), with its *Tikta-Kashaya Rasa* (bitter-astringent taste), *Ruksha-Laghu Guna* (dry-light qualities), and *Ushna Virya* (hot potency), directly counteracts the *Snigdha-Guru* nature of *Kapha* and the *Kleda* associated with *Prameha*. Its *Deepana* (digestive stimulant) and *Yakriduttejaka* (liver stimulant) actions enhance *Agni* and reduce metabolic disturbances, while modern studies affirm berberine's role in improving insulin sensitivity, glucose uptake, and AMPK activation. *Devadaru* (*Cedrus deodara*), sharing similar *Ushna Virya* and *Deepana-Pachana* qualities, facilitates the breakdown of *Ama* (metabolic toxins) and regulates lipid metabolism, crucial in diabetic dyslipidemia. Its *Lekhana* and *Medoghna* properties help reduce excess fat tissue, targeting *Meda Dhatu Dushti*, a key factor in *Sthula* (obese) *Prameha*.

The *Triphala* components - *Haritaki*, *Vibhitaki*, and *Amalaki* - offer *Tridoshaghna*, *Rasayana*, and *Srotoshodhana* (channel-purifying) effects. *Haritaki*, predominantly *Vatahara*, improves gut motility and acts as a mild laxative, aiding in toxin elimination, while modern evidence shows it enhances insulin sensitivity, reduces HbA1c, and up regulates SIRT1 - important in maintaining glucose and lipid homeostasis. *Vibhitaki*, rich in gallic acid, stimulates pancreatic insulin release and helps restore islet cell architecture, while *Amalaki*, with its *Sheeta Virya* and *Raktashodhaka* (blood-purifying) actions, reduces oxidative stress and stabilizes blood glucose levels. Its *Rasayana* effect supports tissue regeneration and *Ojas* preservation, which is often depleted in chronic *Prameha*.

Mustaka (*Cyperus rotundus*), having *Tikta-Kashaya Rasa*, *Laghu-Ruksha Guna*, and *Sheeta Virya*, offers *Lekhana*, *Kledashoshana*, and *Mootrala* actions, which are highly relevant in the management of excessive *Kleda* & turbid urination. Pharmacologically, it inhibits carbohydrate-hydrolyzing enzymes like α -glucosidase and α -amylase, thereby controlling postprandial hyperglycemia and mimicking insulin-like activity by enhancing glucose uptake in muscle tissues.

Collectively, the formulation provides a multidimensional approach: correcting *Agni* (metabolism), reducing *Kleda* and *Meda* (moisture and fat), purifying *Srotas* (channels), protecting *Ojas*, and rejuvenating *Dhatus* (tissues).

These classical actions, supported by scientific evidence such as enhanced insulin sensitivity, glucose regulation, antioxidant activity, and pancreatic beta-cell protection, establish *Darvyadi Kashaya* as an effective holistic therapy for *Prameha* (type 2 diabetes).

Conclusion

This review shows that *Darvyadi Kashaya* is a valuable herbal medicine for managing diabetes, known as *Prameha* in Ayurveda. The combination of herbs in this formulation works together to improve digestion, reduce excess fat and moisture in the body, and support healthy metabolism. Scientific studies have also confirmed that these herbs help lower blood sugar, protect insulin-producing cells, and reduce damage caused by oxidative stress. With support from both *Ayurvedic* texts and modern research, *Darvyadi Kashaya* stands out as a safe and natural option for managing type 2 diabetes in a holistic way.

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