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POTENTIAL ROLE AND ASSESSMENT OF MEDICINAL PROPERTIES OF *BHUNIMBADI CHURNA*: A REVIEW

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Abstract:

Bhunimbadi churna is a traditional *Ayurvedic* propriety formulation comprising of various plants mentioned in the *Ashtanga Hridaya chikitsa sthan* in *Kustha Chiktsa* Chapter 19th . It is traditionally used for treating conditions such as *Kustha* (skin disorders), *Prameha* (~Diabetes mellitus), *Prasupti* (~Numbness), among others. It has therapeutic properties and revitalizing qualities, long shelf life, and increased potency. It helps balance the three *doshas Vata,Pitta,Kapha* and possesses *Bastishodhana karma* (~detoxification properties), helping to purify bodily tissues and eliminate accumulated toxins. It also has *Deepana* (~appetizing) and *Pachana* (~digestive*) karma*, acting as appetizers and digestive agents, respectively, promoting healthy digestion and nutrient assimilation. Collectively, the actions of these drugs contribute to reducing blood sugar levels and alleviating disease symptoms, ultimately leading to an improved quality of life for patients with diabetes. Their comprehensive effects on *dosha* balance, detoxification, digestion, and disease management make them valuable components in the treatment of diabetes.

Keywords: *Bhunimbadi churna, Madhumeha, Prameha,* Ayurvedic Formulations

I. INTRODUCTION:

Ayurveda, India's traditional system of medicine, is aptly defined as the 'science of life and longevity.' With its roots in ancient wisdom, this revered discipline boasts an impressive wealth of knowledge, providing a holistic approach to healthcare that encompasses both prevention and cure. By leveraging the medicinal properties of herbs, metals, and minerals, Ayurveda offers a unique repertoire of treatments for a wide range of ailments.[1] Its expertise in formulating potent, effective dosage forms has been a cornerstone of its success, nurturing overall well-being and empowering individuals to live a balanced, healthy life.

Herbal medicines represent the oldest and most traditional form of healthcare, with a rich history dating back thousands of years. In Ayurveda, herbal medicines are carefully crafted from various parts of plants, including seeds, berries, roots, leaves, bark, and flowers, to harness their medicinal properties.[2] The concept of utilizing medicinal plants for therapeutic purposes originated from indigenous tribal communities, who through their keen observation and knowledge, discovered the healing potential of these plants. This ancient wisdom has been passed down through generations, shaping the foundation of Ayurvedic herbal medicine. Herbal products are of interest to many patients and health care practitioners because 70% of the world populations rely on herbal medicines for part of their primary health care system. Due to several side effects of allopathic medicines in recent years, there has been an increase in the use of herbal medicines.[3]

Bhunimbadi churna is mentioned in *Asthanga Hridaya Chikitsa Sthan* Chapter 19th for various diseases like *Kustha, Prameha, Prasupti* Etc.

Diabetes Mellitus is a serious complex chronic condition characterized by hyperglycemia and a disturbance in metabolism. The incidence of diabetes mellitus is on the rise worldwide. Based on the World Health Organization (WHO) reports, the number of patients is expected to be increasing continuously.[4]

Diabetes Mellitus is associated with impaired glucose metabolism that leads to an increase in free radical production and an increase in triglycerides and lipoproteins level with an increase in the risk of vascular and renal disease.[5] Diabetes Mellitus, with insulin therapy, oral hypoglycemic agents, restricted diet, and exercise either singly or in combination as there are excellent results have been reported with traditional medicines.[6]

Kushtha, an ancient disease described in Ayurvedic texts, is one of the oldest known afflictions to humanity. Dermatological disorders outlined in modern medicine bear striking similarities to *Kushtha Roga*, a chronic and notoriously difficult-to-cure condition. *Kushtha Roga*, encompassing conditions like psoriasis, is a complex, multifactorial disease influenced by various factors, including dietetic habits, behavioral patterns, environmental triggers, genetic predispositions, and immunologic responses. Psoriasis, a chronic inflammatory disease, is characterized by hyperproliferation of keratinocytes in the epidermis, with an increase in the epidermal cell turnover rate, involving immune-mediated, genetic, and environmental components.

II. AIM AND OBJECTIVES

1. To put insight on various references and indications of *Bhunimbadi churna*.
2. To understand the pharmacological properties (*Guna*) and therapeutic action (*Karma*) of *Bhunimbadi churna* according to Ayurvedic pharmacology (*Dravya Guna).*

III. Mechanism of Action of Herbal Drugs:

The mechanism of action of herbal antidiabetics can be grouped as follows-

1. Stimulation of insulin secretion from pancreatic beta cells of islets.

2. Reduction in insulin resistance.

3. Providing essential minerals (calcium, magnesium, manganese, and copper) for beta-cell function.

4. Regenerating/or repairing pancreatic beta cells.

5. Increase in size and number of islet cells in the pancreas.

6. Stimulation of glycogenesis and hepatic glycolysis.

7. Improvement in digestion along with a reduction in blood sugar and urea.[7]

IV. Components of Bhunimbadi Churna:

Table- 1: Contents with proportion of *Bhunimbadi Churna*

S.NO.	Drug	Botanical name (family)	Proportion
1.	*Bhunimba*	*Androagraphis paniculata* Fam- Acanthaceae	1 Part
2.	*Nimba*	*Azadirachta indica* Fam-Meliaceae	1 Part
3.	*Triphala*	*Amalaki* Emblica officinalis Fam – Euphorbiaceae	1 Part
		Haritaki Terminalia chebula Fam – Combretaceae	1 Part
		Vibhitaki Terminalia bellirica Roxb. Fam – Combretaceae	1 Part
4.	*Padmak*	*Prunus puddum* Fam- Rosaceae	1 Part
5.	*Ativisha*	*Aconitum hetrophyllum* Fam- Ranunculaceae	1 Part
6.	*Pippali*	*Piper longum* Fam- Piperaceae	1 Part
7.	*Murva*	*Marsdenia tenacissima* Fam–Asclepiadaceae	1 Part
8.	*Patola*	*Tricosanthes dioica* Fam-Cucurbitaceae	1 Part
9.	*Haridra*	*Curcuma longa* Fam–Zingiberaceae	1 Part
10.	*Daruharidra*	*Berberis arisstata* Fam-Berberdiaceae	1 Part
11.	*Patha*	*Cissampelos pareira* Fam-Menispermaceae	1 Part
12.	*Katuki*	*Picrorhiza kurroa* Fam- Scrophulariaceae	1 Part
13.	*Indravaruni*	*Citrullus colocointhis* Fam-Cucurbitaceae	1 Part
14.	*Kaling*	*Holarrhena antidysentrica* Fam – Apocynaceae	1 Part
15.	*Vacha*	*Acrous calamus* Fam-Araceae	1 Part

16.	*Danti*	*Baliospermum montatum* Fam-Euphorbiaceae	2 Part
17.	*Trivrita*	*Operculina turpethum* Fam-Convovulaceae	4 Part
18.	*Brahmi*	*Bacopa monnieri* Fam-Scophulariaceae	8 Part

Table- 2: *Rasapanchak* of Different Drugs in *Bhunimbadi churna*

Drug	***Rasa***	***Vipaka***	***Veerya***	***Guna***	***Doshagnata***	***Karma***	***Roghnata***
Bhunimba	*Tikta*	*Katu*	*Ushna*	*Laghu, Ruksh*	*Tridhosa*	*Deepan, Paachan, Anuloman. Krimighna*	*Sannipaat Jwar, Kaas, Shotha, Kushta, Krimighna*
Nimba	*Tikta, Kashya*	*Katu*	*Sheeta*	*Laghu*	*Kapha, Pitta*	*Rochan, Grahi, Krimighna, Yaktiutejak*	*Jwar, Aruchi, Krimi, Kustha, Prameha*
Triphala	*Kashaya Pradhan*	*Madhur*	*Anushna*		*Tridosha*	*Deeepan, Chakshushya,*	*Prameh, Kustha*
Padmak	*Tikta, Kashaya*	*Katu*	*Seeta*	*Laghu*	*Kapha, Pitta*	*Vednathapan, Mutral, Vishagna, Aampachak*	*Visarp, Daha, Vishphota, Kustha, Raktapitta*
Ativisha	*Katu, Tikta*	*Katu*	*Ushna*	*Laghu, Ruksha*	*Tridosha*	*Deepan, Pachan, Grahi, Shothhar,*	*Kasa, Jwar, Chardi, Vishgna, Aamatisaar*
Pippali	*Katu*	*Madhur*	*Anushna Sheeta*	*Laghu, Snigdhatik shna*	*Kapha Vatahara*	*Deepan, Triptighna, Vatanuloman, Rakta Vardhak, Kasa Shwasahar, Rasayan*	*Aruchi, Agnimandya, Prameha, Ajirna, Hrid Daurbalya, Pandu, Kasa Kustha, Krimi,*
Murva	*Tikta, Kashaya*	*Katu*	*Ushna*	*Guru, Ruksha*	*Tridosha*	*Deppan, Pachan, Anuloman, Sulprashman,K rimighna*	*Prameh, Hridroga, Kustha, Jwar*
Patola	*Tikta*	*Katu*	*Ushna*	*Laghu, Ruksha*	*Tridoaha*	*Rochna, Deepan, Pachan, Anuloman, Krimighna*	*Kamla, Udarroga, Kandu, Daha*
Haridra	*Katu, Tikta*	*Katu*	*Ushna*	*Laghu, Ruksha*	*Tridosha*	*Lekhan, Ropan, Anuloman*	*Prahmeh, Raktavikar, Shotha,Pandu*
Daruharidra	*Tikta, Kashaya*	*Katu*	*Ushna*	*Laghu, Ruksha*	*Kapha, Pitta*	*Deepan, Paachan, Grahi, Yakrututejak Rasayan*	*Agnimandya, Pravahika, Kamla,*

Patha	*Tikta*	*Katu*	*Ushna*	*Laghu, Tikshna*	*Tridosha*	*Deepan, Pachan, Ghrahi, Krimighna*	*Shola,Jwar, Charidi, Kushta, Atisaar, Hridrog, Gulma*
Katuka	*Tikta*	*Katu*	*Sheeta*	*Laghu, Ruksha*	*Kapha, Pitta*	*Deepan, Krimigna, Malbhedak,*	*Jwar, Prameha Swas,Kaas, Kusta,Krimi*
Indravaruni	*Tikta*	*Katu*	*Ushna*	*laghu, ruksha, Tikshna*	*Kapha-pitta shamak*	*Rechan, Krimighna, Vishagna,*	*Kamla,Pilha Roga,Udarrog Swas,Kaas, Kustha,Gulma Granthi,Vrana Prameha, Mudhgarbh, Aamdosha*
Kaling	*Katu, Kashaya*	*katu*	*sheeta*	*Laghu, Ruksha*	*Kapha-pitta shamak*	*deepan, stambhan, krimighna, raktashodhak, raktastambhak*	*Arsh, Atisaar, Agnimandhya, pravahika, udarshoola*
Vacha	*katu,tikta*	*katu*	*ushna*	*Laghu, Tikshna*	*Kapha-vata shamak*	*medhya, vednasthapak, kaphanisarak, vatanuloman deepan, paachan, krimighna*	*Vibandha, aadhmaan, sulagni, sakrit mutra vishodhni, apsmar, unmaad*
Danti	*Katu*	*Katu*	*Ushna*	*Guru Tikshna*	*Kapha Pittahara*	*Vednasthapan, Deepan, Virechan, Pittasarak, Shothahara, Shwasahara*	*Shotha, Vedna, Arsha, Agnimadnya, Krimi, Shwasa, Ashmari, Vibandha, Jwara*
Trivrita	*Tikta, Katu*	*Katu*	*Ushna*	*Laghu, Ruksha, Tikshna*	*Kaphapitta Samshodhan*	*Bhedan, Rechan, Sukhivirechan, Shothahara, Lekhan*	*Anaha, Vibandha, Arsha, Shotha. Jawara, Vatarakta, Aamvata, Kasa, Shwasa.*
Brahmi	*Tikta, kashaya,ma dhur*	*Madhur*	*Sheeta*	*Laghu*	*kapha vata shamak*	*medhya, shodhhar vednasthapan*	*Kustha, Pandu, prameh, raktavikar, rasayan*

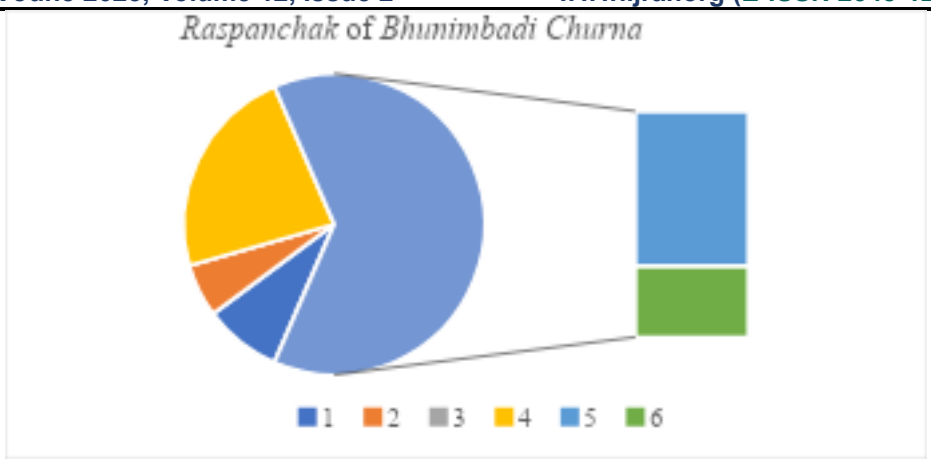

Figure 01: *Raspanchak* of *Bhunimbadi Churna*

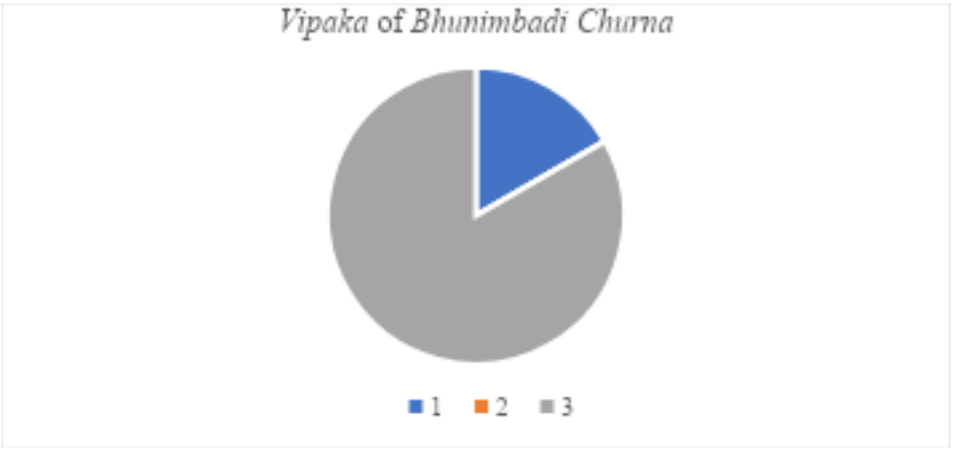

Figure 02: *Vipaka* of *Bhunimbadi Churna*

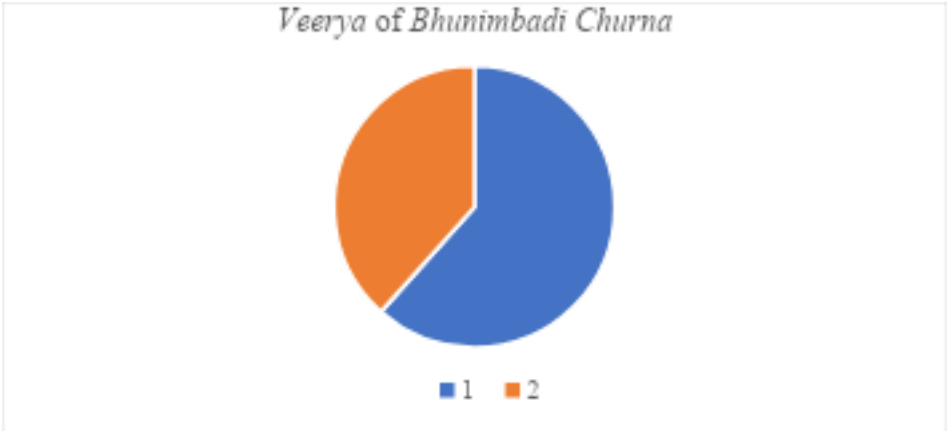

Figure 03: *Veerya* of *Bhunimbadi Churna*

V. Discussion:

Most of the contents of *Bhunimbadi Churna* are having *Katu* (pungent), *Tikta* (bitter), *Kashaya* (astringent) *Rasa* (taste), *Laghu* (light), *Ruksha* (rough) *Guna* (properties), *Katu* (pungent) *Vipaka* (taste after digestion), *Ushna* (hot) *Virya* (potency), *Deepana*, *Pachana Kapha-Pitta Shamaka* properties and hypoglycaemic, antidiabetic activity, Hepatoprotective, hypolipidemic and antioxidant activities which are essential in the management of *Madhumeha* (type 2 diabetes). It helped in pacifying *Mutravaha Srotodushti lakshana* because most of the ingredients are *Tikta-Katu-Kashaya* in *Rasa* having *Kleda-Medo Upashoshana* properties and *Laghu-Ruksha* in *Gunas*. Thus, all these properties may help to regulate the *Udakavaha* and *Medovaha Srotas.*

In conditions such as *Madhumeha* and *Kustha vyadi*, there is an overproduction of *kleda*, which can result in long-term health issues. The components of *Bhunimbadi churna* effectively eliminate this excess *kleda* and facilitate the healing of the disease. Most of the ingredients of *Bhunimbadi Churna* have known hypoglycaemic, antidiabetic activity, Hepatoprotective, hypolipidaemic and antioxidant effects.[8,9]

Studies on Pharmacological Properties of Contents of *Bhunimbadi Churna*

1. Bhunimba

Bhunimba is explained in Ayurvedic classics. It is being used as hepatoprotective in modern medical system. In Ayurveda, it is indicated in *Kushta* (skin diseases), *Kandu* (itching), *Shopha* (swelling), *Yakratroga* (liver diseases), *Krimi* (worms) and *Jwara* (fever). Andrographolide is a major chemical constituent, which is responsible for the hepatoprotective, anti-inflammatory, antipyretic, analgesic, antihypertensive activities etc., in different animal models. Apigenin 7,4'-di-o-methyl ether the flavones is responsible for the anti ulcer activity. Different extracts of the plant shown significant result in different activities viz., anti-cancer, anthelmintic, antibacterial, antifungal, anti-malarial, anti-diarrheal, anti-filarial, antipyretic and anti-inflammatory activities etc., Clinically drug shows significant result in viral hepatitis, elephantiasis, common cold, vitiligo, upper respiratory tract infection and malignant conditions.[10]

2. Nimba

Antihypertensive and Antihyperglycaemic Effects: An alcoholic extract of neem leaf has been reported to produce a significant and dose-related fall in blood pressure[11]. Aqueous neem leaf extract has been found to reduce blood glucose levels and prevent adrenaline and glucose induced hyperglycaemia[12]. Oral administration of aqueous as well as alcoholic neem leaf extracts decreased blood glucose levels in experimentally induced diabetes in rats and rabbits. The antihyperglycemic effect of neem leaf may be due to its anti-serotonin activity[13,14]. Van der Nat et al.[15] suggested that the antidiabetic effect of neem maybe attributed to the release of endogenous insulin by a mechanism similar to that reported for sulphonylurea.

Antidermatophytic Activity: Neem has a remarkable effect on chronic skin conditions that often fail to respond to medical drugs. Local application of a lotion prepared from the 70 per cent alcoholic extract of neem leaves was found to be effective in chronic skin diseases such as eczema, scabies and ringworm infection[16]. Alcoholic neem leaf extract has been reported to control ringworm infection more effectively than salicylic acid and benzoic acid. A mixture of fresh neem leaves and turmeric powder (4:1) was found to be effective in the treatment of scabies[17]. Antidermatophytic activity of neem leaf extract has been documented against different species of dermatophytes including *Trichophyton ruberum, Trichophyton, Mentagrophytes, Trichophyton violaceum, Microsporum nanum and Epidermophyton floccosum*[18].

Hepatoprotective: Effect Both aqueous as well as alcoholic extracts of neem leaf were found to offer protection against paracetamol-induced liver damage[19,20]. The levels of marker enzymes such as aspartate transaminase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP) were elevated 24 hours after paracetamol treatment, whereas rats fed with neem extract prior to paracetamol treatment showed much lower enzyme activities[19]. *Kale et al.*[21] reported the protective effects of neem leaves on hepatotoxicity induced by antitubercular drugs in rats. Aqueous neem leaf extract significantly prevented changes in serum bilirubin, protein, AST, ALT and ALP induced by antitubercular drugs such as isoniazid, rifampicin and pyrazinamide. *Oomacham et al.*[22] reported neem as one of the plants used for the treatment of jaundice.

3. Triphala

Triphala, which include free radical scavenging, antioxidant, anti-inflammatory, immunomodulating, appetite stimulation, gastric hyperacidity reduction, dental caries prevention, antipyretic, analgesic, antibacterial, antimutagenic, wound healing, anticariogenic, antistress, adaptogenic, hypoglycemic, anticancer, hepatoprotective, chemoprotective, radioprotective, and chemopreventive effects.[23]

4. *Padmak*

Padmak seeds exhibits the hypoglycemic activity in albino rat (*Teotia and Sing* 1997) Almond lowers the post prandial glycemia insulinemia and oxidative stress (*Jenkins et al* 2006). It has beneficial effect on serum lipid in healthy adult (Love joy et al 2002) and help anti-obesity activity (*Wein. et al* 2003). The oil is sweet, cooling, antispasmotic, sedative, laxative, vulnerary and rejuvenating and used in hepatopathy[24].

5. Ativisha

Verma et al. demonstrated that the anti-inflammatory activity of ethanolic root extract of A. heterophyllum (225, 450 and 900 mg/kg p.o.) was calculated in cotton pellet-induced granuloma in rats7 . The extract has reduced inflammation as evidenced by reduced weight of cotton pellet in cotton pellet-induced granuloma in rats. The results revealed that the anti-inflammatory properties of extract and the effects were analogous to diclofenac sodium, a standard non-steroidal anti-inflammatory drug. In recent years, there is growing awareness that apart from being safer, economical and simply available herbs, phytochemicals and herbal products can affect the course of inflammatory diseases and may provide an amalgamation of nutritional substances, which help in re-establishing and maintaining wear and tear of tissues. Therefore, it would be rational to logically evaluate the traditional medicines used for their potential use in inflammatory diseases. A. hetrophyllum plant has been reported to hold antifungal cytotoxic, antiviral and immune-stimulant properties.[25-28]

6. *Pippali*

Piper longum has demonstrated significant antidiabetic and antihyperlipidemic activities in several studies. The oil from Piper longum (PLO) and its active component piperine showed potent antidiabetic effects in streptozotocin-induced diabetic rats. Administration of PLO (100 and 200 mg/kg) and piperine (25 and 50 mg/kg) for 28 days reduced blood glucose levels, increased body weight, liver glycogen content, plasma insulin, and HDL cholesterol while decreasing glycosylated hemoglobin, triglycerides, and total plasma cholesterol compared to control groups (*Kumar et al.,* 2013). Interestingly, the aqueous extract of Piper longum root (PlrAqe) also exhibited antihyperglycemic and antihyperlipidemic effects in streptozotocin-induced diabetic rats. A 30-day treatment with PlrAqe (200 mg/kg) significantly decreased fasting blood glucose levels and corrected diabetic dyslipidemia (Nabi et al., 2013). This suggests that different parts of the plant may possess similar therapeutic properties. In conclusion, Piper longum extracts and compounds have shown promising antidiabetic and antihyperlipidemic activities through various mechanisms, including α-glucosidase, aldose reductase, and pancreatic lipase inhibition (*Kumar et al*., 2013). These findings support the traditional use of Piper longum in managing diabetes and related metabolic disorders. However, further research, including clinical trials, is needed to fully elucidate its therapeutic potential and safety profile in humans (*Biswas et al*., 2022).[29-31]

7. *Murva*

Antidiabetic Activity of *Murva* (*Marsdenia tenacissima)*

Marsdenia tenacissima (MT), a member of the Apocynaceae family, is widely used in traditional Chinese medicine for various ailments, including asthma, cancer, and inflammatory conditions.

Phytochemical Basis: It contains bioactive compounds such as C21 steroidal glycosides (e.g., tenacissosides), polyphenols, flavonoids, and triterpenoids. Flavonoids and phenolic compounds are well-known for their antidiabetic effects in other plants, often acting by inhibiting carbohydrate-digesting enzymes (e.g., α-amylase and α-glucosidase), enhancing insulin sensitivity, or reducing oxidative stress—a key factor in diabetes progression. Although specific studies directly testing MT for antidiabetic activity are limited, its antioxidant and anti-inflammatory properties suggest a potential role in managing diabetes-related complications.[32]

Its extracts have shown inhibitory effects on nitric oxide (NO) release in inflammatory models, indicating antioxidant capacity. Oxidative stress exacerbates insulin resistance and β-cell dysfunction in diabetes, so MT's antioxidant effects could theoretically support glucose homeostasis. Additionally, its immunomodulatory effects might help mitigate chronic inflammation associated with type 2 diabetes.[33]

8. Patola

Antidiabetic Activity of Trichosanthes dioica

Trichosanthes dioica, commonly known as pointed gourd or Patola, belongs to the Cucurbitaceae family and has been traditionally utilized in Ayurvedic medicine for managing diabetes mellitus.

Phytochemical Basis: The plant contains bioactive compounds including flavonoids, tannins, saponins, triterpenoids, alkaloids, and peptides, as well as vitamins A and C (Rai et al., 2008). Flavonoids and triterpenoids are recognized for their antidiabetic properties, such as inhibiting carbohydrate-digesting enzymes like α-amylase and α-glucosidase, enhancing insulin secretion, or improving glucose uptake (Kaur & Arora, 2015).[34]

Research by Rai et al. (2008) demonstrated that aqueous fruit extracts of *T. dioica* (1000 mg/kg body weight) significantly reduced fasting blood glucose (FBG) by 28.7% and postprandial glucose by 30.7% in streptozotocin (STZ)-induced severely diabetic rats after 28 days of treatment. The study also noted improvements in lipid profiles and body weight.[35]

Adhikari et al. (2015) found that leaf extracts (800–1600 mg/kg) lowered blood glucose levels in glucose-loaded and normoglycemic rats, with a maximum reduction observed within 3–5 hours, though the effect was less potent than glibenclamide.[36]

In mild diabetic rat models, fruit extracts (500–1250 mg/kg) improved glucose tolerance by reducing blood glucose by 31.3% during glucose tolerance tests, comparable to tolbutamide (Rai et al., 2010).[37]

9. Katuki

Antidiabetic Activity of *Picrorhiza kurroa*

Phytochemical Basis: *P. kurroa* contains bioactive compounds such as iridoid glycosides (e.g., picroside I, picroside II, and kutkoside), phenolic compounds, flavonoids, and cucurbitacins. These constituents, particularly flavonoids and iridoids, are known to exhibit antidiabetic properties by inhibiting carbohydrate-digesting enzymes (α-amylase and α-glucosidase), enhancing insulin secretion, or reducing oxidative stress, which is implicated in diabetes progression (Kaur & Arora, 2015; Nisar et al., 2022).[38-39]

10. Indravaruni

Antidiabetic Activity of *Citrullus colocynthis*

Phytochemical Basis: The plant is rich in bioactive compounds, including cucurbitacins (e.g., cucurbitacin E and I), flavonoids, alkaloids, glycosides, and phenolic compounds, found primarily in its fruits, seeds, and roots (Hussain et al., 2014). Flavonoids and glycosides are known to inhibit carbohydrate-digesting enzymes (α-amylase and α-glucosidase), enhance insulin secretion, or reduce oxidative stress, key mechanisms in diabetes management (Kaur & Arora, 2015).[33]
The antidiabetic effects are attributed to multiple mechanisms: increased insulin release from β-cells (possibly via cucurbitacin-mediated pathways), inhibition of glucose absorption through enzyme inhibition, and antioxidant activity that mitigates oxidative stress in diabetic tissues (Jayaraman & Christina, 2013). The plant's ability to regenerate β-cells and improve insulin sensitivity has also been noted (Abdel-Hassan et al., 2000).

Antidermatophytic Activity of *Citrullus colocynthis*

Phytochemical Basis: The plant's cucurbitacins, flavonoids, and phenolic compounds contribute to its antifungal potential. Cucurbitacins can disrupt fungal cell membranes, while phenolics inhibit fungal enzyme activity or spore germination (Cowan, 1999). These compounds are concentrated in the fruit pulp and seeds.

11. Kaling

Antidiabetic Activity of *Holarrhena antidysenterica*

Phytochemical Basis: The plant contains bioactive compounds such as steroidal alkaloids (e.g., conessine, holarrhimine), flavonoids, phenolic compounds, and triterpenoids, primarily found in its seeds, bark, and leaves (Tiwari et al., 2024)[40]. Flavonoids and phenolic compounds are known to inhibit carbohydrate-digesting enzymes (e.g., α-glucosidase), enhance insulin secretion, and reduce oxidative stress, which are critical in diabetes management (Kaur & Arora, 2015).

The antidiabetic effects are likely mediated by multiple mechanisms: inhibition of α-glucosidase to reduce glucose absorption, stimulation of insulin secretion from pancreatic β-cells (possibly via steroidal alkaloids), and antioxidant activity that protects against oxidative stress in diabetic tissues (Divya et al., 2021)[41]. The plant's ability to enhance glucose uptake and reduce hyperglycemia has been linked to its flavonoid-rich fractions (Bandawane et al., 2013).

Antidermatophytic Activity of *Holarrhena antidysenterica*

Phytochemical Basis: The plant's steroidal alkaloids (e.g., conessine), phenolic compounds, and triterpenoids contribute to its antifungal potential. These compounds can disrupt fungal cell membranes and inhibit growth, a mechanism common to many antimicrobial phytochemicals (Cowan, 1999; Tiwari et al., 2024).

12. *Vacha*

Antidiabetic Activity of *Acorus calamus*

Phytochemical Basis: The plant contains bioactive compounds such as β-asarone, α-asarone, eugenol, phenolic compounds, flavonoids, and volatile oils, primarily found in its rhizomes (Rajput et al., 2014)[42]. Flavonoids and phenolic compounds are known to inhibit carbohydrate-digesting enzymes (e.g., α-amylase and α-glucosidase), enhance insulin sensitivity, and reduce oxidative stress, key factors in diabetes management (Kaur & Arora, 2015).

Antidermatophytic Activity of *Acorus calamus*

Phytochemical Basis: The plant's volatile oils (e.g., β-asarone, eugenol), phenolic compounds, and terpenoids contribute to its antifungal activity. These compounds can disrupt fungal cell membranes, inhibit spore germination, or interfere with fungal enzyme activity (Cowan, 1999; Phongpaichit et al., 2005)[43].

13. Danti

Antidiabetic Activity of *Baliospermum montanum*

Phytochemical Basis: The plant contains bioactive compounds such as flavonoids, triterpenoids, phenolic compounds, glycosides, and steroids, primarily found in its roots, leaves, and seeds (Mali & Wadekar, 2008)[44]. Flavonoids and triterpenoids are known to exhibit antidiabetic effects by inhibiting carbohydrate-digesting enzymes (e.g., α-amylase and α-glucosidase), enhancing insulin sensitivity, or reducing oxidative stress, which are critical in diabetes management (Kaur & Arora, 2015).

Antidermatophytic Activity of *Baliospermum montanum*

Phytochemical Basis: The plant's triterpenoids, phenolic compounds, and glycosides contribute to its antimicrobial activity. Triterpenoids can disrupt fungal cell membranes, while phenolics inhibit fungal growth or spore germination (Cowan, 1999; Tiwari et al., 2023).

Traditional use of *B. montanum* root paste for skin disorders, including infections, in tribal communities of Maharashtra and the Western Ghats supports its potential antidermatophytic role (Mali & Wadekar, 2008)[44].

14. Trivrita

Antidiabetic Activity of Trivrita (Operculina turpethum)

The antidiabetic activity of *Operculina turpethum* is attributed to multiple pharmacological mechanisms:

- **Reduction of Blood Glucose Levels**: Experimental studies in diabetic animal models have consistently demonstrated a significant decrease in fasting blood glucose following administration of *O. turpethum* extracts, indicating its hypoglycemic potential.
- **Antioxidant Properties**: The plant exhibits strong antioxidant activity, which mitigates oxidative stress — a key contributor to β-cell dysfunction and insulin resistance in diabetes mellitus.
- **Regeneration of Pancreatic β-Cells**: Histopathological observations in diabetic rat models suggest that *O. turpethum* promotes the repair and regeneration of damaged pancreatic β-cells, thereby enhancing endogenous insulin secretion.
- **Inhibition of Carbohydrate-Metabolizing Enzymes**: Phytochemicals present in the plant have been shown to inhibit enzymes such as α-amylase and α-glucosidase, leading to delayed carbohydrate digestion and reduced postprandial glucose absorption.[45]

Antidermatophytic Activity of Trivrita (Operculina turpethum)

The antidermatophytic activity of *Operculina turpethum* is primarily mediated through the following mechanisms:

- **Disruption of Fungal Cell Wall Integrity**: The bioactive compounds in *O. turpethum* compromise the structural integrity of fungal cell walls and membranes, leading to leakage of cellular contents and eventual cell death.
- **Inhibition of Spore Germination**: Extracts of *O. turpethum* have demonstrated the ability to inhibit the germination of fungal spores, thereby preventing colonization and spread of dermatophytes on host tissue.
- **Phytochemical Contribution**: The antifungal effect is attributed to the presence of various secondary metabolites, including tannins, saponins, flavonoids, and alkaloids, which are known to possess antimicrobial and antifungal properties through multiple synergistic mechanisms.[46]

15. *Brahmi*

Antidiabetic Activity

The antidiabetic effects of *Bacopa monnieri* are mediated through multiple pharmacological pathways, supported by in vivo and in vitro studies:

- **Reduction of Blood Glucose Levels**: *B. monnieri* extract has demonstrated significant hypoglycemic activity in diabetic animal models, contributing to better glycemic control.
- **Improved Insulin Sensitivity and Glucose Utilization**: Treatment with *B. monnieri* enhances insulin receptor responsiveness and facilitates peripheral glucose uptake, thus improving overall glucose metabolism.
- **Antioxidant Activity**: The plant's rich content of flavonoids and saponins provides antioxidant protection to pancreatic β-cells, helping to prevent oxidative damage associated with diabetes-induced stress.
- **Inhibition of Carbohydrate-Digesting Enzymes**: *B. monnieri* inhibits key enzymes such as α-amylase and α-glucosidase, which delays carbohydrate digestion and absorption, thereby reducing postprandial blood glucose levels.[47]

Antidermatophytic Activity

The antidermatophytic activity of Bacopa monnieri is primarily attributed to the presence of bioactive phytochemicals that exert antifungal effects through the following mechanisms:

- **Disruption of Fungal Cell Membranes and Inhibition of Ergosterol Synthesis:** Active constituents interfere with the integrity and function of fungal cell membranes, leading to leakage of cytoplasmic contents and cell death. Inhibition of ergosterol synthesis—a critical component of fungal membranes—further compromises membrane structure and viability.
- **Inhibition of Spore Germination:** B. monnieri extracts have demonstrated the ability to inhibit the germination of fungal spores, effectively preventing colonization and the spread of dermatophyte infections.
- **Phytochemical Contribution:** The antifungal properties are largely attributed to secondary metabolites such as saponins, flavonoids, alkaloids, and triterpenes. These compounds act synergistically to disrupt fungal physiology and inhibit growth.[48]

VI. Conclusion

Bhunimbadi Churna holds great potential as a standardized Ayurvedic protocol for managing *Madhumeha* (diabetes mellitus) and *Kustha* (skin diseases). With its broad-spectrum therapeutic actions, it serves as a valuable alternative or adjunctive treatment for metabolic and dermatological conditions.

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