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RESEARCH ARTICLE

BRIDGING AYURVEDA AND MODERN MEDICINE: A REVIEW ON MUSTADIKWATHGHANAVATI IN THE MANAGEMENT OF PRAMEHA (TYPE 2 DIABETES MELLITUS)

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Abstract: Prameha, correlated with Type 2 Diabetes Mellitus (T2DM), is a chronic metabolic disorder described in Ayurveda as a Santarpanajanya Vyadhi caused by vitiation of Kapha, Meda and Kleda. Modern pharmacotherapy achieves glycaemic control but rarely restores metabolic balance or prevents progression. Mustadikwathghanavati, a classical polyherbal formulation cited in Bhaishajya Ratnavali, integrates Musta (Cyperus rotundus), Triphala, Haridra (Curcuma longa), Devadaru (Cedrus deodara), Murva (Marsdenia tenacissima), Indravaruni (Citrullus colocynthis), and Lodhra (Symplocos racemosa). These agents exhibit Deepana-Pachana, Medohara and antioxidant properties that normalize Agni and improve insulin sensitivity. Clinical trials demonstrate significant reductions in fasting and post-prandial plasma glucose, HbA1c, BMI and lipid parameters with improved EQ-5D quality-of-life scores[1–3]. This review synthesizes Ayurvedic theory and biomedical evidence, examining pharmacognostic, mechanistic and clinical perspectives of Mustadikwathghanavati as an integrative, safe adjunct in T2DM management.

Keywords: : Prameha, Mustadikwathghanavati, Type 2 Diabetes Mellitus, Deepana-Pachana, Glycaemic Control, Ayurveda.

INTRODUCTION

Diabetes mellitus represents a major public-health burden, with 537 million adults affected globally and projections of 784 million by 2045[4]. India alone accounts for more than 70 million cases and is termed the "Diabetes Capital of the World"[5]. T2DM arises from insulin resistance and β-cell dysfunction, leading to chronic hyperglycaemia and multi-systemic complications[6]. While oral hypoglycaemic agents such as metformin reduce glucose levels, they seldom address oxidative stress or lipid imbalance underlying disease progression[7].

Ayurveda conceptualises this disorder as *Prameha*—a *Kaphaja Maharoga* marked by deranged *Meda* and *Kleda*, manifesting as polyuria, turbid urine and progressive weakness[8]. Its management requires restoration of *Agni* (digestive-metabolic fire) and elimination of *Aama* through *Deepana-Pachana*, *Shodhana* and *Rasayana Chikitsa*[9].

Mustadikwathghanavati is a polyherbal formulation designed to target these principles. Recent clinical evaluation at Bharati Vidyapeeth College of Ayurveda, Pune, demonstrated significant improvement in glycaemic and anthropometric indices when administered with metformin[1]. This review integrates Ayurvedic concepts and modern research to evaluate its therapeutic relevance in integrative diabetes care.

2. Ayurvedic Understanding of Prameha

2.1 Etymology and Classification

"*Prameha*" derives from "*Pra* + *Meha*," meaning excessive urination[10]. *Acharya Charaka* describes twenty types—ten *Kaphaja*, six *Pittaja* and four *Vataja*—progressing to *Madhumeha* if untreated[11]. *Madhumeha* ("honey-like urine") corresponds to T2DM, characterised by sweet, viscous urine and loss of strength (*Ojakshaya*)[12]. Prognostically, *Kaphaja* forms are *Sadhya*, *Pittaja* are *Yapya* and *Vataja* are *Asadhya*[13].

2.2 Pathogenesis (Samprapti): *Prameha* originates from *Agni Mandya* → *Aama formation* → *Meda-Kleda Vriddhi* → *Avarana of Vata* → disturbed *Vyana* and *Apana Vata*, causing polyuria and glycosuria[14]. Sedentary lifestyle (*Avyayama*), *Madhura Ahara* and excessive sleep (*Atinidra*) worsen *Kapha* and *Meda Dhatus*[15]. Thus, treatment targets *Agni* enhancement and *Meda* reduction through diet, exercise and herbal therapies such as *Mustadikwathghanavati*[16].

2.3 Clinical Features: Classical symptoms include *Prabhutamutrata* (polyuria), *Avilmutrata* (turbid urine), *Daurbalya*, *Trishna* and *Kshudhadhikya*[17]. Modern counterparts are polyuria, polydipsia, polyphagia and fatigue[18].

2.4 Need for Integrative Approach: The World Health Organization encourages evidence-based integration of traditional medicine into chronic-disease management[19].

Ayurvedic formulations such as *Mustadikwathghanavati* address both glycaemic parameters and underlying metabolic disharmony, offering multidimensional benefits with minimal toxicity[20].

3. Composition and Pharmacognosy of Mustadikwathghanavati

Ingredient	Botanical Name	Principal Actions (Ayurvedic & Modern)
Musta	*Cyperus rotundus L.*	*Deepana, Pachana*; antioxidant, α-glucosidase inhibition[21]
Triphala	*Emblica officinalis, Terminalia chebula, T. bellirica*	*Rasayana, Medohara*; enhances insulin sensitivity[22]
Haridra	*Curcuma longa L.*	*Kleda-Shoshaka, Kaphahara*; curcumin activates AMPK pathway[23]
Devadaru	*Cedrus deodara Roxb.*	*Srotoshodhaka*; anti-lipid, anti-inflammatory[24]
Murva	*Marsdenia tenacissima*	*Krimighna, Tridoshaghna*; enhances glucose uptake[25]
Indravaruni	*Citrullus colocynthis (L.) Schrad.*	*Lekhana*, purgative; reduces insulin resistance[26]
Lodhra	*Symplocos racemosa Roxb.*	Astringent, *Medohara*; improves lipid metabolism[27]

These constituents share *Tikta-Kashaya Rasa*, *Laghu-Ruksha Guna* and *Katu Vipaka*, making the formulation ideal for *Kapha-Meda Samprapti*. Phytochemical analysis reveals polyphenols, flavonoids, alkaloids and terpenoids responsible for antioxidant and insulin-sensitising effects[28].

4. Mechanistic Insights: Ayurveda–Modern Medicine Interface

4.1 Ayurvedic Mechanisms:

Mustadikwathghanavati acts through four primary Ayurvedic mechanisms[29]:

• Deepana-Pachana – enhances digestive and metabolic Agni, facilitating Aama digestion.

• Kleda-Shoshana – removes excess fluid retention and stabilises internal homeostasis.

• Medohara – corrects lipid accumulation and reduces obesity.

• Rasayana – rejuvenates Dhatus, promotes Ojas and prevents degeneration.

4.2 Biomedical Mechanisms: Modern pharmacological studies support multiple molecular targets:

• Glucose regulation: Curcumin and gallic acid in Triphala increase GLUT-4 translocation and AMPK activation[30].

• Lipid modulation: Polyphenols reduce LDL-C and raise HDL via HMG-CoA reductase inhibition[31].

• Antioxidant activity: Phenolics scavenge reactive oxygen species and protect β-cells[32].

• Anti-inflammatory effect: Down-regulation of NF-κB reduces cytokine-mediated insulin resistance[33].

• Mitochondrial protection: Triphala and Curcuma derivatives enhance mitochondrial biogenesis[34].

4.3 Systems-Biology Perspective: Network-pharmacology models show that polyherbal formulations interact with multiple biochemical nodes (PPAR-γ, AMPK, IRS-1, TNF-α) to restore metabolic homeostasis[35]. This multitarget approach corresponds to Ayurveda's holistic principle of Samyak Prakriti Sthapana—restoring equilibrium among Dosha, Dhatu and Agni[36].

5. Clinical and Experimental Evidence

5.1 Classical Ayurvedic Literature: In Bhaishajya Ratnavali (Prameha Chikitsa Prakarana 37/30–33), Mustadi Kwatha is recommended for Prameha due to its Tikta–Kashaya Rasa and Deepana–Pachana effects[37]. Acharya Charaka and Sushruta emphasised Langhana, Shodhana and Rasayana regimens in chronic Madhumeha, suggesting that formulations such as Mustadi Kwatha not only lower glucose but also prevent Ojakshaya[38] [39].

5.2 Contemporary Clinical Trials: Several clinical investigations substantiate the hypoglycaemic potential of classical Ayurvedic formulations:

• Bagalkoti SP et al. (2019): Lifestyle and Pathyahara–Vihara adherence improved glycaemic indices and reduced fatigue in T2DM patients[40].

• Nair VS (2016): Amrutsaradi Churna significantly decreased fasting blood sugar, post-prandial glucose and HbA1c after 45 days[41].

• Nair SK (2002): Combination of an Ayurvedic compound with glibenclamide produced superior glucose control compared to allopathy alone[42].

Collectively, these findings confirm safety and efficacy as an adjuvant to standard therapy.

5.3 Experimental Evidence: Animal and in-vitro studies demonstrate:

• Cyperus rotundus extracts lower glucose by stimulating pancreatic β-cell regeneration[43].

• Curcuma longa and Triphala exert antioxidant and anti-AGE activity, reducing oxidative stress in diabetic rats[44] [45].

• Symplocos racemosa improves dyslipidaemia by modulating hepatic lipid enzymes[46].

These mechanistic findings corroborate clinical outcomes.

DISCUSSION

Critical Appraisal: The convergence of Ayurvedic and biomedical evidence positions Mustadikwathghanavati as a scientifically plausible integrative therapy for T2DM. Its multi-herbal synergy addresses both upstream causes (Agni Dushti, Meda Vriddhi) and

downstream complications (oxidative and inflammatory cascades).

Strengths:

- Multi-target pharmacology ensuring systemic balance.
- Minimal side-effects and high patient compliance.
- Compatibility with oral hypoglycaemic agents.

Limitations:

- Limited large-scale double-blind studies.
- Inadequate standardisation of raw materials and phytochemical quantification.
- Scarce mechanistic validation through omics and biomarker-based research.

Future Research Directions:

- Standardised clinical protocols adhering to CONSORT-Ayurveda guidelines[47].
- Network-pharmacology and molecular-docking studies to map herb–target interactions.
- Pharmacokinetic profiling to determine bioavailability and herb–drug interactions.
- Evaluation of Prakriti-based patient stratification to individualise therapy.

CONCLUSION

Future Directions: Mustadikwathghanavati represents a classical yet contemporary-relevant formulation offering holistic management of Prameha (T2DM). By harmonising Ayurvedic principles of Deepana-Pachana, Kleda-Shoshana, Medohara and Rasayana Chikitsa with molecular mechanisms such as AMPK activation and NF-κB inhibition, it bridges the gap between traditional and modern paradigms. Evidence from controlled trials demonstrates clinically significant glycaemic improvement and metabolic restoration without adverse effects.

Future integrative diabetes management should employ rigorous multi-centric trials, validated analytical standardisation and bioinformatics to confirm efficacy and safety. Adoption of such evidence-based Ayurveda can reduce disease burden and support the WHO's call for pluralistic healthcare systems.

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