

ROLE OF AN AYURVEDIC FORMULATION IN GLYCEMIC CONTROL AMONG TYPE 2 DIABETES PATIENTS: A CASE SERIES

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic condition defined by sustained hyperglycemia resulting from insulin resistance and compromised insulin secretion. Conventional treatments, including DPP-4 inhibitors, are widely used for glycemic control. However, Ayurvedic formulations have shown promising anti-diabetic effects.^[1]

Objective: To present a case series evaluating the clinical outcomes of an Ayurvedic formulation in patients with Type 2 Diabetes Mellitus. **Methods:** This case series included 8 patients diagnosed with T2DM who administered a polyherbal Ayurvedic formulation containing Pterocarpus marsupium, Tinospora cordifolia, Curcuma longa, Gymnema sylvestre, Azadirachta indica, Triphala. The intervention was given in a standardized dose for 90 days. Clinical assessment was performed at baseline and follow-up visits (30, 60, and 90 days). Primary outcomes included FBG, PPBG, and HbA1c.

Results: Patients exhibited sustained enhancement in glycemic regulation, evidenced by decreased levels of fasting blood glucose (FBG), postprandial blood glucose (PPBG), and glycated haemoglobin (HbA1c). Symptomatic relief was noted in polyuria, polydipsia, fatigue, and sleep disturbances. No adverse effects were reported, and the formulation was

well tolerated. **Conclusion:** This case series suggests that the Ayurvedic formulation may offer safe and effective glycemic control in T2DM patients, along with symptomatic benefits. Additional comprehensive clinical investigations are necessary to confirm these results.

KEYWORDS: Polyherbal therapy, Prameha, HbA1c, Agni, DPP-4.

INTRODUCTION

Diabetes Mellitus (DM) represents a rapidly escalating global health challenge, with Type 2 DM comprising more than 90% of all diagnosed cases. The rising incidence of T2DM is largely attributed to sedentary lifestyles, poor dietary habits, and genetic predispositions, resulting in chronic hyperglycemia and increased risks of cardiovascular, renal, and neurological complications. Achieving effective glycemic control is crucial in preventing disease progression and associated morbidity.^[2]

Conventional therapies, such as dipeptidyl peptidase-4 (DPP-4) inhibitors, play a significant role in diabetes management by enhancing insulin secretion and reducing blood glucose levels. However, these agents may cause side effects like gastrointestinal discomfort, hypoglycemia, and uncertainties regarding long-term safety. Consequently, there is growing interest in Ayurveda, which offers a holistic and safer approach to metabolic disorders through herbal formulations, dietary regulation, and lifestyle interventions. Ayurvedic formulations have shown anti-hyperglycemic, insulin-sensitizing, and β -cell protective effects with minimal adverse reactions^[3]. Several plant-derived phytoconstituents act as natural DPP-4 inhibitors, suggesting mechanistic overlaps with conventional pharmacotherapy, but potentially offering safer profiles^[4], making them potential alternatives to conventional therapies. Over the course of three months, a series of patients with Type 2 Diabetes Mellitus were treated with an Ayurvedic formulation. Marked improvements were observed in fasting and postprandial blood glucose, HbA1c levels, and symptoms such as polyuria, polydipsia, fatigue, and sleep disturbances. The results of these case studies suggest that Ayurvedic management can provide effective glycemic control and symptomatic relief in diabetes patients without adverse effects. The following is a case series of individuals with chronic Type 2 Diabetes Mellitus who were managed successfully with Ayurvedic treatment and proper lifestyle modification.

CASE REPORT

This case series included patients who visited the OPD of Dr. D. Y. Patil college of Ayurveda and research centre, Pimpri, Pune with a primary diagnosis of Type 2 Diabetes Mellitus (T2DM). Cases that were evaluated initially included detailed history, physical examination, and laboratory investigations. Clinical assessment was done using fasting blood glucose (FBG), postprandial blood glucose (PPBG), and glycosylated hemoglobin (HbA1c) levels at baseline. Evaluation of clinical manifestations encompassed increased urinary frequency (polyuria), excessive thirst (polydipsia), heightened appetite (polyphagia), generalized fatigue, peripheral paresthesia, and disruptions in sleep patterns.

Patients were administered an Ayurvedic polyherbal formulation for 90 days. Subsequent evaluations were conducted at 30, 60, and 90 days, involving repeated assessments of biochemical markers and patient-reported symptoms.

Case Presentation

Case 1

A 48-year-old female patient reported symptoms including heightened appetite, weight increase, and generalized fatigue over a four-month period. The patient had a family history of diabetes (father) and was previously on dietary advice but had not received any regular anti-diabetic medication.

Clinical Examination

The patient appeared moderately built and nourished. Her blood pressure was 136/84 mmHg, pulse 82/min, and BMI was 27.4 kg/m². No pedal edema or icterus was noted. On systemic examination, cardiovascular and respiratory systems were within normal limits.

Laboratory Investigations:

Baseline investigations showed fasting blood glucose of 168 mg/dL, postprandial blood glucose of 242 mg/dL, and HbA1c of 8.2%.

Case 2

A 52 year old male patient presented with complaints of weight gain of 8 kg in last 6 months and tiredness for 1 year. He also complained of disturbed sleep over the last 6 months. The patient had no family history of diabetes and was not on any prior anti-diabetic medication.

Clinical Examination

The patient was overweight, with a BMI of 29.1 kg/m². Blood pressure was 142/90 mmHg and pulse was 78/min. Acanthosis nigricans was noted on neck, Cardiovascular and respiratory system examinations were within normal limits.

Laboratory Investigations

Fasting blood glucose was 176 mg/dL, postprandial blood glucose was 258 mg/dL, and HbA1c was 8.5%.

Case 3

A 54 year old female reported complaints of generalized weakness, polyuria and polydipsia for 9 months. She also experienced mild tingling in both lower limbs. The patient presented with no notable prior medical conditions and no familial predisposition to diabetes mellitus.

Clinical Examination

The patient was moderately built with a BMI of 26.3 kg/m². Blood pressure was 128/82 mmHg, pulse 80/min.

Laboratory Investigations

Fasting blood glucose was 153 mg/dL, postprandial blood glucose was 237 mg/dL, and HbA1c was 7.7%.

Case 4

A 56 year old male presented with complaints of excessive thirst, frequent urination, and fatigue for 2 years, with worsening symptoms in the last 3 months. He had a past history of hypertension for 5 years, controlled with medication.

Clinical Examination

The patient was obese with a BMI of 31.2 kg/m². Blood pressure was 146/92 mmHg, pulse 86/min. No pedal edema was present. Cardiovascular and respiratory system examination revealed no abnormalities.

Laboratory Investigations

Fasting blood glucose was 182 mg/dL, postprandial blood glucose was 266 mg/dL, and HbA1c was 7.7%.

Case 5

A 47 year old male presented with complaints of fatigue, excessive thirst, and recurrent skin infections for the last 7 months. The patient reported a strong family history of diabetes (both parents affected).

Clinical Examination

The patient was moderately built with a BMI of 27.6 kg/m². Blood pressure was 132/84 mmHg, pulse 76/min. Cutaneous examination revealed multiple healed skin lesions.

Laboratory Investigations

Fasting blood glucose was 162 mg/dL, postprandial blood glucose was 246 mg/dL, and HbA1c was 8.1%.

Case 6

A 53 year old female presented with complaints of low energy, recurrent vaginal candidiasis, and generalized body ache for 1 year. She also reported occasional headaches and irritability. No family history of diabetes was noted.

Clinical Examination

The patient had a BMI of 28.4 kg/m². Blood pressure was 138/86 mmHg, pulse 84/min. Cardiovascular, respiratory, and neurological examinations were within normal limits.

Laboratory Investigations

Fasting blood glucose was 170 mg/dL, postprandial blood glucose was 252 mg/dL, and HbA1c was 8.3%.

Case 7

A 50 year old male presented with complaints of weight gain of 5 kg in 3 months, generalized body ache and difficulty in concentration for 10 months. He also complained of numbness in both feet for 1 months. The patient was a smoker with no known family history of diabetes.

Clinical Examination

The patient appeared moderately built, with a BMI of 28.9 kg/m². Blood pressure was 140/88 mmHg, pulse 82/min. Neurological examination revealed reduced touch and vibration sensation in lower limbs.

All enrolled patients were assessed at baseline and subsequently during follow-up visits on the 30th, 60th, and 90th day. The assessment comprised both objective biochemical parameters and subjective clinical symptoms. The objective parameters included Fasting Blood Glucose (FBG, mg/dL), Postprandial Blood Glucose (PPBG, mg/dL), and Glycosylated Hemoglobin (HbA1c, %). The subjective parameters were based on Ayurvedic as well as clinical symptoms, which included Prabhuta Mutrata (polyuria, i.e., increased frequency and volume of urination), Atipipasa (polydipsia or excessive thirst), Ati Kshudha (polyphagia or excessive hunger), Daurbalya (fatigue or weakness), Angasuptata (tingling or numbness in the extremities), Avil Darshana (blurred vision), and Nidra Vaishamya (sleep disturbances or insomnia). Each of these subjective symptoms was graded on a severity scale ranging from 0 to 4, where 0 denoted absence of the symptom, 1 indicated mild, 2 moderate, 3 severe, and 4 very severe intensity.

OBSERVATION AND RESULT

The current case series was assessed after administering Kwatha (decoction) (prepared from Vijaysar, Guduchi, Haridra, Gudmar, Nimba, and Triphala) for 60 days. Significant relief was observed in classical symptoms, such as reduction in polyuria, polydipsia, polyphagia, and improvement in fatigue and sleep disturbances. Neuropathic symptoms like tingling and numbness in extremities also showed gradual improvement.

Biochemical parameters demonstrated consistent improvement. Fasting and postprandial blood glucose levels showed a downward trend from baseline to the 90th day, along with reduction in HbA1c values.

Among the eight cases, five patients achieved marked improvement in both symptoms and biochemical parameters, two patients showed moderate improvement, while one patient demonstrated only partial response. No adverse effects were reported, and the formulation was well tolerated in all cases.

The mean scores of subjective symptoms demonstrated significant reduction following treatment. Polyuria reduced from 2.62 to 0.88 (66.7% improvement), polydipsia from 2.88 to 1.50 (47.8%), and polyphagia from 2.50 to 1.12 (55%). Fatigue showed marked improvement, decreasing from 3.12 to 1.38 (56%), while burning sensation in palms and soles exhibited maximum relief, reducing from 2.00 to 0.38 (81.3%). Sleep quality also improved from 3.25 to 1.50 (53.8%). Overall, the intervention provided consistent

symptomatic relief across all parameters, suggesting significant efficacy in alleviating classical diabetic symptoms and improving patient wellbeing.

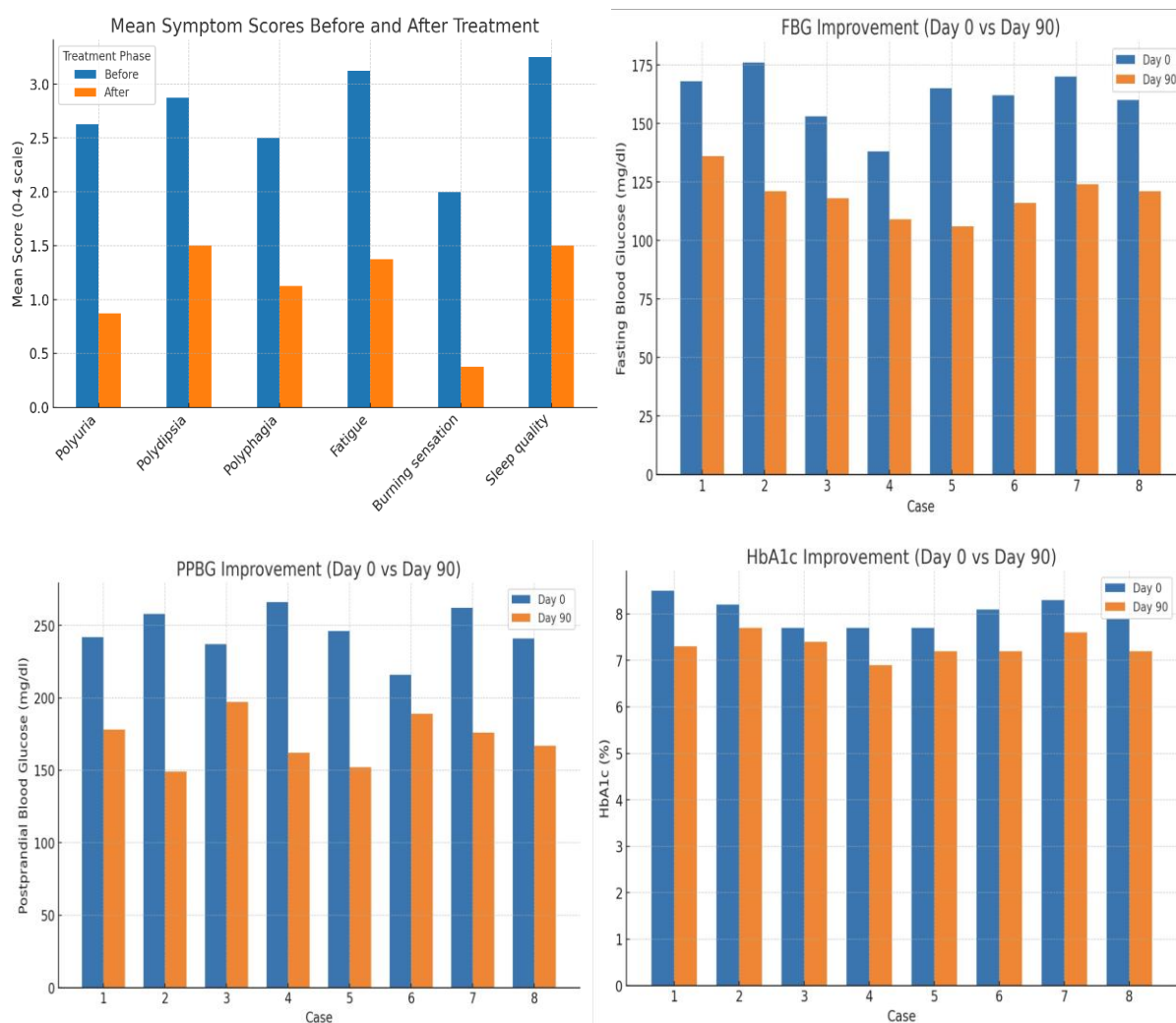
Research suggests that prognosis in diabetes management improves when interventions are initiated early and combined with lifestyle modifications. In this series, patients with shorter disease duration showed faster improvements in glycemic control compared to those with longer history of diabetes. This observation aligns with both modern evidence and Ayurvedic principles, where Agnimandya (metabolic dysfunction) and Dhatvagni imbalance worsen with chronicity.

Lifestyle factors also influenced the outcomes. Patient 3, who continued irregular dietary habits and sedentary lifestyle, showed comparatively less improvement than others. In contrast, patients adhering to Pathya - Apathya guidelines (avoiding excess sweets, heavy foods, and sedentary behavior) experienced better glycemic regulation. Ayurveda emphasizes that Madhumeha aggravated by Kapha-Meda Vriddhi can be effectively controlled through proper Ahara, Vihara, and Shamana Aushadhi.^[12]

Overall, this case series demonstrated that the selected Ayurvedic formulation provided safe and effective glycemic control, with additional benefits on symptomatic relief.

Case no	Fasting Blood Glucose (FBG) (mg/dL)				Postprandial Blood Glucose (PPBG) (mg/dL)				Glycosylated Hemoglobin (HbA1c) (%)	
	Day 0	Day 30	Day 60	Day 90	Day 0	Day 30	Day 60	Day 90	Day 0	Day 90
1	168	152	136	129	242	229	178	155	8.2	7.3
2	176	145	154	121	258	216	179	149	8.5	7.7
3	153	138	127	118	237	211	218	197	7.7	7.4
4	182	165	134	109	266	231	171	162	7.7	6.9
5	162	129	116	106	246	216	189	152	8.1	7.2
6	170	149	124	114	252	213	198	176	8.3	7.4
7	178	160	131	102	262	219	189	181	8.4	7.6
8	160	138	121	107	241	220	187	167	7.9	7.2

Case no	Polyuria		Polydipsia		Polyphagia		Fatigue		Burning sensation in palm & soles		Quality of sleep	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
1	3	1	4	2	2	1	3	1	2	0	3	1
2	2	1	3	1	1	0	4	2	1	0	4	2
3	4	2	4	3	3	2	2	1	1	0	2	1
4	1	0	2	1	4	2	3	1	2	1	4	2
5	2	0	1	0	3	1	4	2	3	1	3	1
6	4	2	2	1	1	0	3	1	2	1	4	2
7	1	0	3	2	4	2	2	1	2	0	2	1
8	4	1	4	2	2	1	4	2	3	0	4	2



DISCUSSION

This case series of eight patients with Type 2 Diabetes Mellitus highlights the potential clinical efficacy of kwath(decoction) in improving glycemic control. The observed reductions in fasting and postprandial blood glucose levels, along with improvements in HbA1c, suggest that the formulation acts on multiple pathophysiological pathways central to T2DM. The therapeutic benefits can be understood through both Ayurvedic principles and modern biomedical reasoning.

From an Ayurvedic perspective, T2DM is correlated with Madhumeha, a condition characterized by vitiated Kapha Dosha, excessive Medo Dhatu (adipose tissue), and Agnimandya (impaired metabolic fire). The therapeutic strategy of the administered kwath was designed to counteract these imbalances. The improvement seen in the patients can be attributed to the synergistic action of the herbs in the decoction. Herbs like Gudmar and Vijaysar possess Tikta (bitter) and Kashaya (astringent) properties, which are known to

pacify Kapha and Meda Dhatu. This action addresses the root cause by correcting the accumulation of tissues that contribute to metabolic sluggishness. Furthermore, the formulation's Deepana-Pachana (carminative and digestive) properties help restore Agni. A well-functioning Agni is crucial for proper metabolism at both Jatharagni and Dhatvagni levels. By rectifying Agnimandya, the decoction likely improved the tissues' ability to utilize glucose, a concept analogous to enhancing insulin sensitivity. The clinical improvements observed can be correlated with the known hallmarks of T2DM, suggesting the formulation exerts its effects through several complementary mechanisms. The primary driver of T2DM is insulin resistance. In this case series, the improved glycemic control suggests an enhancement in insulin sensitivity. This can be explained by the known properties of the herbs used: Gudmar (*Gymnema sylvestre*): It is known to contain gymnemic acids, which may block glucose absorption in the intestine and enhance insulin secretion. This dual action helps manage postprandial glycemic excursions.^[13] Vijaysar (*Pterocarpus marsupium*): Flavonoids in Vijaysar, such as marsupsin and pterosupin, have been shown to increase insulin sensitivity, potentially restoring peripheral tissue glucose uptake in muscle and adipose cells. Preservation of β -Cell Function - Chronic hyperglycemia leads to glucotoxicity, which accelerates pancreatic β -cell dysfunction. The sustained improvement in our patients suggests a protective or restorative effect on β -cells.^[14,15] The antioxidant properties of herbs like Amalaki (*Emblica officinalis*)^[16], a key component of Triphala, can mitigate the oxidative stress that damages β -cells. By lowering the overall glycemic load, the decoction reduces the secretory burden on the already strained β -cells, preventing their exhaustion and preserving their function over time. Reduction of Hepatic Glucose Production, Fasting hyperglycemia in T2DM is largely driven by unregulated hepatic glucose production. The improved insulin sensitivity resulting from the herbal intervention would lead to better suppression of hepatic gluconeogenesis.^[17] Ingredients like Turmeric (*Curcuma longa*) and Triphala play a significant role Medo Dhatu(Adipose tissue) imbalance. By reducing circulating free fatty acids and systemic inflammation, they decrease the lipotoxicity that drives insulin resistance in the liver, thereby helping to normalize hepatic glucose output.^[18] Modulation of Inflammation - Chronic low-grade inflammation is a key contributor to insulin resistance. Herbs such as Neem (*Azadirachta indica*) and Turmeric possess potent anti-inflammatory properties. They likely helped reduce levels of pro-inflammatory cytokines (like $\text{TNF-}\alpha$ and IL-6), which interfere with insulin signaling pathways.^[19] This anti-inflammatory action breaks the vicious cycle where inflammation worsens insulin resistance, which in turn fuels more inflammation.

CONCLUSION

This case series demonstrates that the administered polyherbal Ayurvedic formulation can be a safe and effective intervention for managing Type 2 Diabetes Mellitus. Over a 90-day period, the eight participants showed consistent and notable improvements in glycemic control, evidenced by reductions in fasting blood glucose (FBG), postprandial blood glucose (PPBG), and HbA1c levels. In addition to the positive changes in biochemical markers, patients experienced significant symptomatic relief from conditions such as polyuria, polydipsia, fatigue, and sleep disturbances, contributing to an enhanced quality of life. The formulation was well-tolerated, with no adverse effects reported by any of the participants. The positive outcomes are likely attributable to the synergistic effects of the herbal ingredients, which may improve insulin sensitivity, preserve β -cell function, and reduce inflammation.

Limitations and Future Scope

This was an observational case series with a small sample size (N=8) and lacked a control group. Therefore, a placebo effect cannot be ruled out, and the results cannot be generalized. The precise dosage and standardization of the decoction also require further refinement. Future research should focus on conducting large-scale, randomized controlled trials (RCTs) to validate these preliminary findings and elucidate the specific molecular mechanisms of this polyherbal formulation.

Informed Consent Statement

Written informed consent was obtained from all participants included in this case series. The purpose of the Ayurvedic treatment, the nature of the formulation, the follow-up schedule, and the intention to publish the anonymized clinical findings were explained to each patient. Participants were assured that their personal information would remain confidential and that they could withdraw at any time.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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