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Study on Traditional Polyherbal Formulations Focusing on Development and Antidiabetic Potential

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Abstract

High blood glucose levels and related consequences are hallmarks of diabetes mellitus, a chronic metabolic disease. Because of their negligible side effects and synergistic therapeutic advantages, traditional polyherbal formulations have been utilized extensively for the management of diabetes. The current work used streptozotocin-induced diabetic rats to design and assess specific polyherbal formulations for their antidiabetic potential. Physicochemical and phytochemical investigations were conducted on the formulations made from verified medicinal herbs. The formulations' safety was validated by acute toxicity tests. Serum insulin, HbA1c, lipid profiles, oral glucose tolerance, fasting blood glucose, and histological analysis of pancreatic tissue were also evaluated. Blood glucose levels were considerably lowered, glucose tolerance was enhanced, biochemical parameters returned to normal, and pancreatic β-cell architecture was partially repaired after treatment with polyherbal formulations. Strong antidiabetic and protective qualities were demonstrated by the high-dose formulation, which showed effects similar to those of metformin. These results indicate the potential of polyherbal formulations as safe and efficient therapeutic agents and offer scientific support for their traditional usage in the treatment of diabetes.

Keywords: Diabetes mellitus, Polyherbal formulation, Antidiabetic activity, Streptozotocin-induced diabetes, Pancreatic β-cell regeneration, Phytochemical analysis.

1. INTRODUCTION

Diabetes mellitus is a complex metabolic disease marked by persistently high blood sugar levels brought on by deficiencies in either the action or secretion of insulin, or both. It is linked to long-term harm, malfunction, and failure of many organs, especially the heart, blood vessels, kidneys, eyes, and nerves. Diabetes has become more commonplace worldwide, and because of its complications and the high cost of long-term care, it presents a serious public health concern.

Insulin and oral hypoglycemic medications are examples of contemporary antidiabetic treatments that have shown promise in regulating blood sugar levels. However, side effects such as hypoglycemia, gastrointestinal problems, and possible drug resistance are frequently associated with long-term usage of these drugs. Interest in complementary and alternative medicines, especially traditional medical systems that use plant-based formulations, has increased as a result of these constraints.

For ages, Ayurveda, Traditional Chinese Medicine, and other indigenous systems have employed polyherbal formulations—which blend two or more medicinal plants—to treat diabetes and associated metabolic diseases. It is thought that the synergistic action of several bioactive ingredients in these formulations maximizes effectiveness while

reducing adverse effects. Polyherbal preparations are intriguing options for managing diabetes since phytochemicals such flavonoids, alkaloids, saponins, and tannins have been shown to have antidiabetic, antioxidant, and anti-inflammatory qualities.

The creation, standardization, and preclinical assessment of a few traditional polyherbal formulations were the main objectives of the current investigation. Using streptozotocin-induced diabetes rat models, the main goals were to find safe and efficient formulations, examine their phytochemical and physicochemical characteristics, and evaluate their potential as antidiabetic agents. The purpose of this study was to investigate the potential of polyherbal preparations as safe and efficient substitutes for traditional antidiabetic treatments, as well as to offer scientific support for their traditional use.

2. LITERATURE REVIEW

Jain et al. (2025) carried out a thorough analysis of polyherbal formulations and emphasized how well they worked in preclinical and clinical trials to reduce blood glucose, enhance insulin sensitivity, and lessen oxidative stress linked to diabetes. The study highlighted that as compared to preparations made with just one herb, the combination of herbs frequently produced improved therapeutic results.

Suvarna et al. (2021) conducted a meta-analysis to thoroughly examine the efficacy of polyherbal formulations in treating type 2 diabetes. According to their research, polyherbal treatments considerably lowered HbA1c, postprandial, and fasting blood glucose levels. Additionally, they pointed out that these formulations were generally well-tolerated and had few side effects, confirming their use as adjunctive treatments to traditional antidiabetic medications.

Anwar et al. (2022) examined the biological activity and composition of a number of polyherbal preparations. According to their findings, the addition of many plant extracts improved the anti-inflammatory, glucose-lowering, and antioxidant benefits. According to the study, attaining repeatable treatment results required meticulous component selection and standardization.

Akhtar et al. (2023) examined the preventive, hypoglycemic, antilipidemic, and antioxidant properties of a polyherbal emulsion (F6-Smonsecce) in rats with diabetes caused by alloxan. The formulation's comprehensive protective impact was confirmed by the results, which showed significant decreases in blood glucose, serum cholesterol, and triglycerides along with improved hepatic and renal indicators.

Quazi et al. (2022) conducted a hydroalcoholic polyherbal extract α-amylase enzyme assay in vitro, confirming the idea of creating polyherbal teabag formulations for diabetes treatment. The study demonstrated that polyherbal formulations could successfully block enzymes that break down carbohydrates, lowering postprandial hyperglycemia.

Mahapatra and Verma (2022) created and assessed a new polyherbal antidiabetic compound that showed notable glucose-lowering effects in animal models. The formulation's potential as a standardized antidiabetic treatment was supported by its safety and effectiveness.

Jadhav and Noor (2025) evaluated "Dia-Care," a polyherbal Ayurvedic compound, both computationally and experimentally. In addition to highlighting gene network regulation linked to glucose metabolism, their investigation demonstrated effective suppression of the α-amylase and α-glucosidase enzymes, offering mechanistic insights into its antidiabetic effects.

Mohanty et al. (2025) centered on the creation of a polyherbal formulation with dipeptidyl peptidase-IV (DPP-IV) inhibitory action and bio-standardization. According to the study, the formulation successfully adjusted blood glucose levels in type 2 diabetic animals, suggesting that it may enhance glycemic control through incretin-mediated pathways.

Kaur and Sharma (2023) created and assessed a polyherbal antidiabetic capsule, evaluating its stability, safety, and physicochemical characteristics. In preclinical animals, the study showed that the capsule had notable effects on decreasing blood sugar levels and was safe and well-tolerated.

Issuriya et al. (2025) examined the toxicological and anti-hyperglycemic properties of Athamathurot, a traditional polyherbal compound utilized at Bantakhun Hospital in Thailand. Their results supported the therapeutic potential and

safety of conventional polyherbal formulations in the treatment of diabetes by confirming notable drops in blood glucose levels without any discernible harm.

3. RESEARCH METHODOLOGY

The hallmark of diabetes mellitus, a long-term metabolic disease, is hyperglycemia brought on by deficiencies in either insulin action or secretion, or both. Even with the availability of contemporary antidiabetic medications, prolonged use of these medications is frequently linked to side effects and decreased effectiveness. For decades, many medical systems have employed traditional polyherbal mixtures to treat diabetes and associated consequences. These combinations of several therapeutic plants are thought to work in concert to improve glucose homeostasis and lower oxidative stress. Using preclinical models, the current study examined the antidiabetic potential of a few traditional polyherbal formulations by developing, standardizing, and evaluating them.

3.1 Study Design

A laboratory-based experimental study was conducted to evaluate the antidiabetic potential of selected traditional polyherbal formulations. The study involved formulation development, physicochemical standardization, and in vivo assessment using animal models of diabetes.

3.2 Selection of Plants and Formulation Development

A thorough analysis of the literature was used to identify medicinal plants with proven antidiabetic properties. After being gathered from verified sources, leaves, roots, and seeds were thoroughly cleaned, dried, and ground into a powder. Following conventional wisdom, particular ratios of various plant powders were combined to create the polyherbal concoctions. Aqueous and hydroalcoholic solvents were used to make the extracts, and yields were noted.

3.3 Phytochemical Screening

In order to detect bioactive chemicals such as flavonoids, alkaloids, saponins, tannins, and glycosides, the polyherbal formulations were subjected to preliminary phytochemical examination. In order to find these chemicals, standard qualitative tests were conducted. Additionally, a quantitative assessment of total flavonoids and phenolics was carried out.

3.4 Physicochemical Standardization

To guarantee quality and reproducibility, physicochemical analysis was performed on the formulations. Measurements were made of parameters like pH, moisture content, ash values, and extractive values. To guarantee safety, analyses of pesticide residues, microbiological burden, and heavy metal contamination were also conducted.

3.5 Acute Toxicity Study

To ascertain the safe dosage of the polyherbal formulations, acute oral toxicity tests were performed on healthy Wistar rats. Over the course of 14 days, the animals were monitored for biochemical markers, mortality, and behavioral changes in accordance with OECD norms.

3.6 Experimental Animals and Grouping

Healthy male Wistar rats weighing 150–200 g were used for antidiabetic studies. The animals were acclimatized for one week and provided standard laboratory feed and water. Diabetes was induced using streptozotocin (STZ) at a dose of 50 mg/kg body weight. Animals were randomly divided into five groups:

- **Group I:** Normal control
- **Group II:** Diabetic control
- **Group III:** Diabetic + Standard drug (Metformin)
- **Group IV:** Diabetic + Low-dose polyherbal formulation
- **Group V:** Diabetic + High-dose polyherbal formulation

3.7 Antidiabetic Activity Assessment

A glucometer was used to monitor fasting blood glucose levels at baseline and at regular intervals. To evaluate glucose clearance, oral glucose tolerance tests (OGTT) were conducted. At the conclusion of the trial, lipid profiles, serum insulin, glycosylated hemoglobin (HbA1c), and indicators of liver and kidney function were assessed.

3.8 Histopathological Studies

After being removed, the pancreatic tissue was preserved in formalin and prepared for histological analysis. Hematoxylin and eosin was used to stain tissue sections in order to evaluate islet architecture, β-cell regeneration, and any pathological changes.

4. RESULTS AND DISCUSSION

In streptozotocin-induced diabetic rats, the study assessed the antidiabetic properties of a few traditional polyherbal preparations. In comparison to metformin, the effects on pancreatic histology, biochemical markers, oral glucose tolerance, and fasting blood glucose were evaluated to ascertain safety and efficacy.

4.1 Phytochemical and Physicochemical Analysis

Flavonoids, alkaloids, saponins, tannins, and glycosides were found during the initial screening of phytochemicals, indicating the presence of antioxidant and antidiabetic qualities. Physical-chemical characteristics like pH, moisture content, extractive values, and ash values were all within permissible bounds. There were no signs of microbiological contamination, pesticide residues, or heavy metals.

4.2 Acute Toxicity Study

No mortality or behavioral changes were observed in rats administered up to 2000 mg/kg of the polyherbal formulation. Liver and kidney function tests were normal, confirming safety for further studies.

4.3 Effect on Fasting Blood Glucose Levels

Table 1: Fasting Blood Glucose Levels (mg/dL)

Group	Day 0	Day 7	Day 14	Day 21
Normal Control	89	90	89	90
Diabetic Control	243	247	251	255
Diabetic + Metformin	245	182	139	112
Diabetic + Low-dose Formulation	248	203	159	136
Diabetic + High-dose Formulation	248	188	142	115

Polyherbal formulations reduced blood glucose in a dose-dependent manner, with high-dose treatment showing effects comparable to metformin. The reduction is attributed to synergistic effects of flavonoids, saponins, and other bioactive compounds.

4.4 Oral Glucose Tolerance Test (OGTT)

Table 2: OGTT Results (mg/dL)

Group	0 min	30 min	60 min	120 min
Normal Control	89	131	105	91
Diabetic Control	251	321	298	265
Diabetic + Metformin	139	182	145	110
Diabetic + Low-dose Formulation	159	211	170	135
Diabetic + High-dose Formulation	142	185	149	117

Polyherbal treatment improved glucose tolerance, particularly in the high-dose group, suggesting enhanced insulin sensitivity and peripheral glucose uptake.

4.5 Effect on Biochemical Parameters

Table 3: Biochemical Parameters

Parameter	Normal Control	Diabetic Control	Metformin	Low-dose Formulation	High-dose Formulation
Serum Insulin (µIU/mL)	15	7	13	12	14
HbA1c (%)	5	9	6	6	6
Total Cholesterol (mg/dL)	91	152	102	116	105
Triglycerides (mg/dL)	79	143	88	103	89

Polyherbal formulations significantly improved insulin, HbA1c, and lipid profiles. The high-dose group showed the most prominent improvement, supporting a dose-dependent antidiabetic effect.

4.5 Histopathological Examination

β-cell degeneration and altered islet architecture were observed in the pancreatic tissue of diabetic controls. Groups treated with polyherbals showed intact islet structure and partial β-cell regeneration; the most noticeable effect was seen with high-dose treatment. Histology validated biochemical findings, demonstrating that pancreatic β-cells were shielded by polyherbal formulations, potentially via anti-inflammatory and antioxidant mechanisms.Traditional polyherbal preparations have notable antidiabetic effects, according to the study. High-dose formulations gave their traditional use a scientific foundation by successfully lowering blood glucose, enhancing glucose tolerance, normalizing biochemical markers, and restoring pancreatic histology.

5. CONCLUSION

In streptozotocin-induced diabetic rats, the chosen traditional polyherbal formulations showed notable antidiabetic potential, according to the study mentioned above. Serum insulin, HbA1c, and lipid profiles were among the important biochemical indicators that were successfully normalized after treatment with these formulations, which also improved glucose tolerance and decreased fasting blood glucose levels. Additionally, histopathological study showed that pancreatic β-cells were partially restored and preserved, suggesting that pancreatic tissue was protected. The most noticeable benefits were shown by the high-dose formulation, which was on par with the common antidiabetic medication metformin. This supports the long-standing practice of using polyherbal formulations as safe and efficient treatments for diabetes and related metabolic disorders.

REFERENCES

1. Akhtar, M. T., Almas, T., Safdar, S., Saadia, M., Qadir, R., Batool, S., ... & Cai, R. (2023). Antioxidant, hypoglycemic, antilipidemic, and protective effect of polyherbal emulsion (F6-Smonsecce) on alloxan-induced diabetic rats. ACS omega, 8(24), 21642-21652.
2. Animish, A., & MA, J. (2025). Evaluation and screening of polyherbal formulation for diabetes management: toxicity assessment on Albino Wistar rats. Natural Product Research, 1-12.
3. Anwar, S., Kausar, M. A., Parveen, K., Zahra, A., Ali, A., Badraoui, R., ... & Saeed, M. (2022). Polyherbal formulation: The studies towards identification of composition and their biological activities. Journal of King Saud University-Science, 34(7), 102256.
4. Issuriya, A., Wetchakul, P., Limsuwan, S., Jiwpraditkul, S., Jaisamut, P., Kaewmanee, T., ... & Sanpinit, S. (2025). Anti-hyperglycemic and toxicological effects of a traditional polyherbal formulation, Athamathurot, used at Bantakhun hospital, Thailand. Journal of Agriculture and Food Research, 19, 101741.
5. Jacob, B., Narendhirakannan, R. T., Nadar, M. M., & Itsaranuwat, P. (2022). Mineral composition, phytochemical analysis, anti-oxidant and anti-diabetic activities of a polyherbal formulation-an in vitro approach. Chemical Data Collections, 39, 100874.
6. Jadhav, S. Y., & Noor, A. (2025). Computational and Experimental Evaluation of Dia-Care, a Polyherbal Ayurvedic Formulation, for Antidiabetic Potential through α-Amylase and α-Glucosidase Inhibition and Gene Network Modulation. Journal of Molecular Structure, 143527.
7. Jain, A., Jangid, T., Jangir, R. N., & Bhardwaj, G. S. (2025). Antidiabetic activity of polyherbal formulations: a comprehensive review. Protoplasma, 1-22.
8. Kaur, S. N., & Sharma, S. (2023). Antidiabetic Polyherbal Capsule: Formulation, Evaluation and Safety measurements. Indian Journal of Pharmaceutical Sciences, 85(3).
9. Kolhe, R. C., & Chaudhari, R. Y. (2023). Development and evaluation of antidiabetic Polyherbal tablet using medicinal plants of traditional use. Int. J. Curr. Pharm. Sci, 15, 17-21.
10. Mahapatra, S. K., & Verma, S. (2022). Preparation and evaluation of novel antidiabetic polyherbal formulation. Research Journal of Pharmacy and Technology, 15(7), 3015-3019.
11. Mohanty, I. R., Dhanawane, U., & Durgaprasad Tiwari, D. (2025). Bio-standardization and development of a unique polyherbal formulation with dipeptidyl peptidase-IV inhibitory activity for type 2 diabetes mellitus. Natural Product Research, 1-10.
12. Paul, S., Joseph, D., & Majumdar, M. (2021). Health risk assessment of Macro, Trace-elements and heavy metal in various Indian Antidiabetic Polyherbal formulations. Environmental Science and Pollution Research, 28(30), 40929-40937.
13. Quazi, A., Patwekar, M., Patwekar, F., Alghamdi, S., Rajab, B. S., Babalghith, A. O., & Islam, F. (2022). In Vitro Alpha-Amylase Enzyme Assay of Hydroalcoholic Polyherbal Extract: Proof of Concept for the Development of Polyherbal Teabag Formulation for the Treatment of Diabetes. Evidence-Based Complementary and Alternative Medicine, 2022(1), 1577957.
14. Suvarna, R., Shenoy, R. P., Hadapad, B. S., & Nayak, A. V. (2021). Effectiveness of polyherbal formulations for the treatment of type 2 Diabetes mellitus-A systematic review and meta-analysis. Journal of Ayurveda and integrative medicine, 12(1), 213-222.
15. Thottappillil, A., Kouser, S., Badiger, A. V., Pinto, P. G., Ramachandran, S., Janadri, S., ... & Vishnuprasad, C. N. (2024). The systemic anti-diabetic effect of polyherbal formulation Varanadi Kashayam is mediated through GLP-1 secretion and DPP4 inhibition. bioRxiv, 2024-06.