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SCIENTIFIC VALIDATION OF THE ANTIDIABETIC POTENTIAL OF ETHANOLIC LEAF EXTRACT OF *TECOMA STANS* (L.) JUSS. EX KUNTH IN STREPTOZOTOCIN-INDUCED EXPERIMENTAL DIABETES

Khushi Upadhyay[1], K. Ram Prasad[2], Jayapal Reddy Gangadi[3], Manish Kumar Mishra[4]

[1]*- PG Student, Faculty of Pharmaceutical Sciences, Motherhood University, Dehradun Road, Karoundi Village, Bhagwanpur Post, Roorkee Tehsil, Haridwar District, Uttarakhand State-247661.

[2]- M. Pharmacy Supervisor, Faculty of Pharmaceutical Sciences, Motherhood University, Dehradun Road, Karoundi Village, Bhagwanpur Post, Roorkee Tehsil, Haridwar District, Uttarakhand State-247661.

[3]- Professor, Faculty of Pharmaceutical Sciences, Motherhood University, Dehradun Road, Karoundi Village, Bhagwanpur Post, Roorkee Tehsil, Haridwar District, Uttarakhand State-247661.

[4]- Principal- Faculty of Pharmaceutical Sciences, Motherhood University, Dehradun Road, Karoundi Village, Bhagwanpur Post, Roorkee Tehsil, Haridwar District, Uttarakhand State-247661.

Abstract:

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycaemia resulting from impaired insulin secretion, insulin resistance, or both. It has emerged as one of the leading global health concerns owing to its increasing prevalence and the development of severe complications affecting the cardiovascular, renal, nervous, and visual systems. Although several synthetic antidiabetic drugs are available, their prolonged use is often associated with adverse effects, reduced therapeutic efficacy, and high treatment costs. These limitations have prompted increasing interest in medicinal plants as potential sources of safe, effective, and affordable therapeutic agents. Tecoma stans (L.) Juss. ex Kunth, a member of the family Bignoniaceae, has been traditionally used in various systems of medicine for the treatment of diabetes and other metabolic disorders. However, comprehensive scientific validation of its antidiabetic potential remains limited.

The present study was undertaken to investigate the phytochemical composition, evaluate the safety profile, and assess the antidiabetic activity of the ethanolic leaf extract of Tecoma stans using experimental animal models. Fresh leaves were collected, authenticated, shade dried, and extracted with 50% ethanol using the Soxhlet extraction method. The extract was subjected to preliminary phytochemical screening employing standard qualitative procedures to identify the major classes of bioactive constituents. Acute oral toxicity was evaluated according to OECD Guideline 423. The antihyperglycemic activity of the extract was investigated using the Oral Glucose Tolerance Test (OGTT) and streptozotocin–nicotinamide-induced diabetic Wistar rats. The extract was administered orally for 28 consecutive days, and fasting blood glucose levels, body weight, food intake, and water consumption were monitored at regular intervals. Statistical analysis of the experimental data was performed using one-way analysis of variance (ANOVA) followed by Dunnett's multiple comparison test.

The Soxhlet extraction process yielded 33.2% (w/v) ethanolic extract, indicating efficient extraction of ethanol-soluble phytoconstituents. Qualitative phytochemical screening confirmed the presence of alkaloids, flavonoids, tannins, phenolic compounds, saponins, carbohydrates, proteins, amino acids, and glycosides, suggesting a

chemically diverse phytochemical profile. Acute oral toxicity studies demonstrated that the extract was safe up to an oral dose of 2000 mg/kg, with no mortality or treatment-related behavioural abnormalities observed during the study period. In the Oral Glucose Tolerance Test, the extract significantly improved glucose tolerance by reducing the postprandial rise in blood glucose levels. Chronic administration of the ethanolic extract to streptozotocin-induced diabetic rats produced a significant and progressive reduction in fasting blood glucose levels throughout the 28-day treatment period. Furthermore, the extract effectively prevented diabetes-induced loss of body weight and improved the overall metabolic condition of diabetic animals. The antihyperglycaemic activity exhibited by the extract was comparable to that of the standard antidiabetic drug, indicating substantial therapeutic efficacy.

The findings of the present investigation demonstrate that the ethanolic leaf extract of Tecoma stans possesses significant antidiabetic activity along with a favourable safety profile in experimental animals. The observed pharmacological effects are likely attributable to the synergistic action of flavonoids, alkaloids, phenolic compounds, tannins, and saponins, which may enhance insulin secretion, improve peripheral glucose utilization, reduce oxidative stress, and protect pancreatic β-cells from damage. The study scientifically validates the traditional use of Tecoma stans in the management of diabetes mellitus and highlights its potential as a promising natural source for the development of plant-based antidiabetic therapeutics. Nevertheless, further phytochemical characterization, molecular investigations, long-term toxicity studies, and well-designed clinical trials are required to identify the active constituents and establish their efficacy and safety in human subjects.

Keywords: *Tecoma stans; Diabetes mellitus; Streptozotocin; Ethanolic extract; Phytochemical screening; Antidiabetic activity; Herbal medicine; Wistar rats; Hyperglycaemia; Medicinal plants.*

Corresponding author:

Khushi Upadhyay,

PG Student, Faculty of Pharmaceutical Sciences,
Motherhood University, Dehradun Road,
Karoundi Village, Bhagwanpur Post,
Roorkee Tehsil, Haridwar District,
Uttarakhand State-247661.

Email Id: khushiupadhyay392@gmail.com.

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INTRODUCTION:

Diabetes mellitus represents one of the fastest-growing non-communicable diseases worldwide and poses a major challenge to global healthcare systems. The disease is characterized by chronic elevation of blood glucose concentrations resulting from inadequate insulin secretion, impaired insulin action, or a combination of both. Persistent hyperglycaemia progressively damages multiple organ systems, leading to serious microvascular complications such as nephropathy, retinopathy, and neuropathy, as well as macrovascular disorders including coronary artery disease and stroke.

According to the International Diabetes Federation, the global prevalence of diabetes has increased dramatically over recent decades, largely because of sedentary lifestyles, unhealthy dietary habits, obesity, and population ageing. India continues to bear one of the highest burdens of diabetes worldwide and is frequently referred to as the "diabetes capital" because of its rapidly expanding diabetic population. The increasing incidence of type 2 diabetes among younger adults further highlights the urgent need for effective preventive and therapeutic strategies.

Current pharmacological management includes insulin preparations and oral hypoglycaemic agents such as sulfonylureas, biguanides, thiazolidinediones, DPP-4 inhibitors, SGLT2 inhibitors, and GLP-1 receptor agonists. Although these medications effectively control blood glucose levels, prolonged therapy is frequently associated with adverse effects including hypoglycaemia, gastrointestinal disturbances, weight gain, oedema, and cardiovascular concerns. Furthermore, lifelong dependence on synthetic drugs imposes a considerable financial burden on patients, particularly in developing countries.

Medicinal plants have historically served as valuable sources of therapeutic agents. Approximately 80% of the world's population relies partially on herbal medicines for primary healthcare. Traditional systems such as Ayurveda describe numerous medicinal plants possessing hypoglycaemic properties, many of which have subsequently

demonstrated pharmacological efficacy through experimental studies.

Among these medicinal plants, Tecoma stans (L.) Juss. ex Kunth, belonging to the family Bignoniaceae, has attracted increasing scientific interest. Commonly known as Yellow Elder or Yellow Trumpet Bush, the plant is widely distributed throughout tropical and subtropical regions. Traditionally, its leaves have been employed in the treatment of diabetes, gastrointestinal disorders, microbial infections, and inflammatory diseases.

Phytochemical investigations have revealed that Tecoma stans contains several biologically active secondary metabolites including flavonoids, alkaloids, tannins, phenolic compounds, saponins, terpenoids, and glycosides. These constituents exhibit antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, and antidiabetic properties. Flavonoids and phenolic compounds are known to protect pancreatic β-cells against oxidative stress, while alkaloids and saponins have been reported to improve insulin secretion and peripheral glucose utilization.

Despite its extensive traditional use, comprehensive scientific validation of the antidiabetic efficacy of Tecoma stans remains limited. Therefore, the present investigation was undertaken to evaluate the phytochemical composition, acute oral toxicity, and antidiabetic potential of the ethanolic leaf extract of Tecoma stans using streptozotocin-induced diabetic Wistar rats. The findings of this study are expected to contribute to the scientific evidence supporting the therapeutic application of this medicinal plant and may facilitate the future development of plant-based antidiabetic formulations.

MATERIALS AND METHODS:

Plant Material

Fresh leaves of Tecoma stans (L.) Juss. ex Kunth were collected from the local region of Roorkee, Uttarakhand, India, during the flowering season. The plant material was authenticated by a qualified taxonomist, and a voucher specimen was deposited in the departmental herbarium for future reference. The collected leaves were washed thoroughly with distilled water to remove adhering dust and foreign matter, shade-dried at room temperature for approximately two weeks, and pulverized into a coarse powder using a mechanical grinder. The powdered material was stored in airtight containers until further use.

Preparation of Ethanolic Extract

Approximately 500 g of the dried leaf powder was extracted using ethanol in a Soxhlet extraction apparatus. Extraction was continued until the siphon tube became colourless, indicating complete extraction of soluble constituents. The extract was concentrated under reduced pressure using a rotary vacuum evaporator and further dried on a water bath at controlled temperature. The dried extract was weighed to determine the percentage yield and stored in amber-coloured airtight containers at 4°C until used for phytochemical and pharmacological investigations.

Preliminary Phytochemical Screening

The ethanolic extract was subjected to qualitative phytochemical analysis using standard pharmacognostic procedures. The extract was screened for alkaloids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds, saponins, proteins, amino acids, steroids, fixed oils, gums, and mucilage. Standard chemical tests, including Molisch's, Benedict's, Fehling's, Dragendorff's, Mayer's, Wagner's, Shinoda, Ferric chloride, Foam, Biuret, Ninhydrin, Liebermann–Burchard, and Keller–Killiani tests, were performed according to established protocols. The presence or absence of phytoconstituents was determined based on characteristic colour changes or precipitate formation.

Stability Studies

The ethanolic extract was evaluated for short-term stability by storing it in airtight amber-coloured containers under refrigerated, room-temperature, and accelerated conditions. Samples were periodically examined for changes in colour, odour, consistency, and phytochemical profile over the study period. The stability assessment confirmed that the extract retained its physical appearance and major phytochemical constituents throughout storage, indicating satisfactory stability under the prescribed conditions.

Experimental Animals

Healthy adult Wistar albino rats of either sex weighing 180–220 g was procured from a CPCSEA-registered animal breeding facility. Animals were housed under standard laboratory conditions with a temperature of 22 ± 2°C, relative humidity of 55 ± 10%, and a 12-hour light/dark cycle. Standard pellet diet and water were provided ad libitum. Animals were acclimatized for one week before initiation of the experiments. All experimental procedures were conducted in accordance with CPCSEA guidelines and were approved by the Institutional Animal Ethics Committee.

Acute Oral Toxicity Study

The acute oral toxicity study was performed according to OECD Guideline 423 (Acute Toxic Class Method). Female Wistar rats were fasted overnight before administration of the ethanolic

extract. A limit dose of 2000 mg/kg body weight was administered orally, and the animals were observed continuously during the first four hours and periodically for 24 hours, followed by daily observation for 14 days. Clinical signs of toxicity, behavioural changes, food and water intake, body weight, and mortality were recorded. No mortality or significant toxic manifestations were observed during the observation period, indicating that the extract was safe at the tested dose. Based on these findings, experimental doses were selected for the pharmacological studies.

Induction of Experimental Diabetes

Experimental diabetes was induced using streptozotocin (STZ) following nicotinamide pre-treatment to establish a model resembling type 2 diabetes mellitus. Nicotinamide was administered intraperitoneally, followed by STZ dissolved in freshly prepared citrate buffer (pH 4.5). After 72 hours, fasting blood glucose levels were measured using a glucometer. Animals exhibiting fasting blood glucose levels greater than 200 mg/dL were considered diabetic and included in the study.

Experimental Design

Animals were randomly divided into different experimental groups comprising normal control, diabetic control, standard drug-treated, and extract-treated groups. The ethanolic extract was administered orally at the selected doses once daily for 28 consecutive days. Glibenclamide was used as the reference standard drug. Body weight, food intake, water consumption, and fasting blood glucose levels were monitored at predetermined intervals throughout the treatment period.

Oral Glucose Tolerance Test

The Oral Glucose Tolerance Test (OGTT) was conducted to evaluate the effect of the extract on glucose utilization. Overnight-fasted rats received the test extract or standard drug, followed by oral administration of glucose solution. Blood glucose levels were measured at predetermined intervals after glucose loading using blood samples collected from the tail vein. The glucose-lowering effect of the extract was compared with that of the standard drug and control groups.

Evaluation of Antidiabetic Activity

The antidiabetic effect of the ethanolic extract was assessed by measuring fasting blood glucose levels at regular intervals during the treatment period. Additional parameters, including body weight, food intake, and water consumption, were recorded to evaluate the overall metabolic status of the experimental animals. The efficacy of the extract was compared with the diabetic control and Glibenclamide-treated groups.

Statistical Analysis

All experimental data were expressed as Mean ± Standard Error of Mean (SEM). Statistical analysis was carried out using GraphPad Prism software. Differences among the experimental groups were analysed using one-way analysis of variance (ANOVA), followed by Dunnett's multiple comparison test. A value of $p < 0.05$ was considered statistically significant.

RESULTS:

Percentage Yield of Ethanolic Extract

The dried leaves of *Tecoma stans* were extracted using the Soxhlet hot percolation method with 50% ethanol. The extraction yielded a dark green semisolid mass with an average extractive value of 33.2% (w/v), indicating efficient extraction of ethanol-soluble phytoconstituents.

Table 1. Percentage Yield of Ethanolic Extract of *Tecoma stans* Leaves

Plant	Plant Part	Extraction Method	Solvent	Extractive Yield (% w/v)
Tecoma stans (L.) Juss. ex Kunth	Dried leaves	Soxhlet hot percolation	50% Ethanol	**33.2**

Preliminary Phytochemical Screening

Qualitative phytochemical analysis demonstrated that the ethanolic extract contained several pharmacologically important secondary metabolites. Alkaloids, carbohydrates, flavonoids, tannins, saponins, proteins, and amino acids were detected, indicating that the extract possesses a rich phytochemical profile that may contribute to its anti-hyperglycaemic activity.

Table 2. Qualitative Phytochemical Screening of Ethanolic Leaf Extract

Phytochemical Constituent	Result
Alkaloids	+
Carbohydrates	+
Flavonoids	+
Tannins	+
Saponins	+
Proteins	+
Amino acids	+
Glycosides	+*
Steroids	–
Fixed oils and fats	–

(+): Present, (–): Absent

Acute Oral Toxicity Study

The acute oral toxicity study performed according to OECD Guideline 423 demonstrated that the ethanolic extract was well tolerated up to 2000 mg/kg body weight. No mortality or treatment-related signs of toxicity were observed throughout the 14-day observation period, indicating that the extract possesses a favourable safety profile.

Table 3. Acute Oral Toxicity of Ethanolic Extract

Parameter	Observation
OECD Guideline	423
Maximum Dose	2000 mg/kg
Mortality	Nil
Behavioural changes	Not observed
Tremors/Convulsions	Not observed
Food intake	Normal
Water intake	Normal
Body weight	No significant abnormality
Estimated LD_{50}	>2000 mg/kg

Oral Glucose Tolerance Test (OGTT)

The Oral Glucose Tolerance Test demonstrated that glucose loading produced a marked increase in serum glucose concentration in the normal control group. Pre-treatment with the ethanolic extract significantly attenuated the glucose-induced rise in blood glucose levels.

One hour after glucose administration, the normal control group exhibited a 43.4% increase in serum glucose, whereas the Glibenclamide-treated group showed only a 9.0% increase. Animals treated with the ethanolic extract exhibited increases of 20.5% and 21.0% at the lower and higher doses, respectively. At the second hour, the extract reduced blood glucose by 13.0% (lower dose) and 16.5% (higher dose). Based on these observations, the higher dose was selected for further pharmacological evaluation in the streptozotocin-induced diabetic model.

Table 4. Summary of Oral Glucose Tolerance Test Findings

Experimental Group	Key Observation
Normal control	43.4% increase in serum glucose after 1 h
Glibenclamide (10 mg/kg)	9.0% increase after 1 h
Extract (200 mg/kg)	20.5% increase after 1 h; 13.0% reduction at 2 h
Extract (Higher dose reported in thesis)	21.0% increase after 1 h; 16.5% reduction at 2 h

Effect of Ethanolic Extract on Fasting Blood Glucose Levels

Repeated oral administration of the ethanolic extract for 28 days significantly reduced fasting blood glucose levels in streptozotocin-induced diabetic rats. The antihyperglycaemic effect increased progressively throughout the treatment period.

The Glibenclamide-treated group showed reductions in blood glucose of 7.1%, 45.5%, 50.1%, and 53.9% on the 7th, 14th, 21st, and 28th day, respectively. The ethanolic extract-treated group exhibited reductions of 12.3%, 33.3%, 49.5%, and 59.7% over the same period. These reductions were statistically significant ($P < 0.001$) compared with the diabetic control group.

Table 5. Percentage Reduction in Blood Glucose During the Treatment Period

Treatment Group	Day 7	Day 14	Day 21	Day 28
Glibenclamide (10 mg/kg)	7.1%	45.5%	50.1%	53.9%
Ethanolic extract	12.3%	33.3%	49.5%	59.7%

Effect on Body Weight

Untreated diabetic rats showed progressive body weight loss during the study period. Treatment with Glibenclamide and the ethanolic extract significantly prevented this reduction, indicating improvement in metabolic status and glycaemic control.

Table 6. Effect of Ethanolic Extract on Body Weight of STZ-Induced Diabetic Rats

Group	Baseline (g)	Day 21 (g)	Day 28 (g)
Normal control	180.0 ± 2.0	180.9 ± 3.2	182.2 ± 3.1
Diabetic control	164.1 ± 7.1	155.0 ± 7.0	123.0 ± 10.2**
Diabetic + Glibenclamide (10 mg/kg)	153.8 ± 9.5	155.1 ± 6.7**	152.6 ± 8.4***
Diabetic + Ethanolic extract	152.0 ± 5.1	151.3 ± 7.3**	156.0 ± 7.3***

DISCUSSION:

Diabetes mellitus is a complex metabolic disorder characterized by chronic hyperglycaemia resulting from impaired insulin secretion, insulin resistance, or a combination of both. Persistent elevation of blood glucose levels leads to disturbances in carbohydrate, lipid, and protein metabolism and eventually contributes to the development of severe microvascular and macrovascular complications. Although several synthetic hypoglycaemic agents are available, their long-term use is frequently associated with adverse effects, high treatment costs, and inadequate glycaemic control. Consequently, medicinal plants continue to attract considerable attention as alternative therapeutic agents because of their efficacy, safety, affordability, and multitarget mechanisms of action.

The present investigation was undertaken to scientifically evaluate the antidiabetic potential of the ethanolic leaf extract of Tecoma stans using established experimental models of diabetes. The findings demonstrated that the extract possesses significant antihyperglycaemic activity and supports the traditional use of the plant in the management of diabetes mellitus.

Extraction using 50% ethanol yielded 33.2% (w/v) of semisolid extract, indicating efficient extraction of ethanol-soluble phytoconstituents. Hydroalcoholic solvents are widely recognized for their ability to extract a broad spectrum of bioactive compounds, including flavonoids, alkaloids, tannins, glycosides, and phenolic compounds. The relatively high extractive yield observed in the present study suggests that Tecoma stans leaves contain a substantial amount of polar and moderately polar phytochemicals that may contribute to their pharmacological activity.

Qualitative phytochemical screening confirmed the presence of alkaloids, flavonoids, carbohydrates, tannins, phenolic compounds, saponins, proteins, amino acids, and cardiac glycosides in the ethanolic extract. These findings are consistent with previous phytochemical investigations of Tecoma stans, which have reported the occurrence of several biologically active secondary metabolites responsible for its medicinal properties. The coexistence of multiple phytochemical classes suggests that the observed antidiabetic activity is likely the result of synergistic interactions among these constituents rather than the action of a single compound.

Among the identified phytochemicals, flavonoids and phenolic compounds are considered particularly important because of their potent antioxidant activity. Oxidative stress plays a central role in the pathogenesis of diabetes by damaging pancreatic β-cells, impairing insulin secretion, and promoting insulin resistance. Flavonoids neutralize reactive oxygen species, reduce lipid peroxidation, preserve endogenous antioxidant enzymes, and protect pancreatic tissue from oxidative injury. Phenolic compounds further enhance antioxidant defence mechanisms and improve glucose homeostasis by modulating key enzymes involved in carbohydrate metabolism.

Alkaloids present in Tecoma stans may also contribute significantly to its antihyperglycaemic effect. Previous studies have reported that monoterpene alkaloids isolated from Tecoma stans, such as Tecomanine and tecostanine, exhibit hypoglycaemic activity by enhancing insulin release, improving peripheral glucose utilization, and increasing cellular glucose uptake. Similarly, saponins have been reported to delay intestinal glucose absorption, improve insulin sensitivity, and stimulate pancreatic insulin secretion. Therefore, the combined presence of flavonoids, alkaloids, phenolics, tannins, and saponins provides a strong pharmacological basis for the antidiabetic activity observed in the present study.

The acute oral toxicity study demonstrated that the ethanolic extract was well tolerated at doses up to 2000 mg/kg body weight, with no mortality or treatment-related behavioural abnormalities during the observation period. The absence of significant toxicity indicates a favourable safety profile and suggests that the extract possesses a wide therapeutic index. These observations are consistent with previous toxicological investigations of Tecoma stans, which have also reported low acute toxicity following oral administration. The safety profile observed in the present study supports the potential use of the extract for long-term therapeutic applications, although further sub chronic and chronic toxicity studies are required before clinical use.

The Oral Glucose Tolerance Test demonstrated that pre-treatment with the ethanolic extract significantly improved glucose tolerance following oral glucose administration. The ability of the extract to attenuate postprandial hyperglycaemia suggests that it may enhance insulin secretion, improve insulin sensitivity, facilitate peripheral glucose uptake, or delay intestinal glucose absorption. Since postprandial hyperglycaemia is recognized as an independent risk factor for cardiovascular complications in diabetic patients, improvement in glucose tolerance represents an important therapeutic advantage.

The streptozotocin-induced diabetic rat model was selected because it closely resembles several pathological features of human diabetes mellitus. Streptozotocin selectively damages pancreatic β-cells through DNA alkylation and oxidative stress, resulting in impaired insulin secretion and persistent hyperglycaemia. In the present study, untreated diabetic animals exhibited sustained elevation of blood glucose throughout the experimental period, confirming successful induction of diabetes.

Repeated oral administration of the ethanolic extract for 28 days produced a progressive and significant reduction in fasting blood glucose levels. The antihyperglycaemic effect increased with treatment duration, indicating cumulative pharmacological activity rather than an immediate transient response. The glucose-lowering effect observed at the end of the treatment period was comparable to that produced by the standard drug Glibenclamide, suggesting that the extract possesses considerable therapeutic potential.

The exact mechanism responsible for the antihyperglycaemic activity of Tecoma stans cannot be established solely from the present investigation. However, based on the phytochemical composition and published literature, several mechanisms may be proposed. These include stimulation of residual pancreatic β-cell function, enhancement of insulin secretion, improvement of insulin sensitivity, inhibition of intestinal carbohydrate digestion and glucose absorption, suppression of hepatic gluconeogenesis, increased glycogen synthesis, and protection of pancreatic tissue from oxidative stress. The combined contribution of these mechanisms may explain the significant reduction in fasting blood glucose observed in extract-treated animals.

Diabetes-induced body weight loss is a common consequence of insulin deficiency and impaired glucose utilization. In the absence of adequate insulin, proteins and lipids are extensively catabolized to meet energy requirements, leading to progressive weight reduction. In the present investigation, untreated diabetic animals exhibited marked body weight loss throughout the experimental period. Conversely, treatment with the ethanolic extract significantly prevented body weight reduction and promoted gradual recovery of body mass. Improvement in body weight may be attributed to enhanced glucose utilization, improved protein synthesis, reduced muscle wasting, and restoration of normal metabolic function following glycaemic control.

The findings of the present investigation are in agreement with previous experimental studies demonstrating the antidiabetic activity of Tecoma stans leaf extracts. Similar studies have reported significant reductions in blood glucose levels, improvement in antioxidant status, preservation of pancreatic architecture, and enhancement of insulin secretion following administration of different extracts of Tecoma stans. The consistency between the present findings and previous reports strengthens the scientific evidence supporting the traditional use of this medicinal plant for diabetes management.

Despite the promising results, the present study has certain limitations. The active phytochemical constituents responsible for the observed pharmacological activity were not isolated or quantified. Biochemical markers such as serum insulin, glycated haemoglobin (HbA1c), lipid profile, oxidative stress markers, and inflammatory cytokines were not evaluated. Histopathological examination of pancreatic tissue was also beyond the scope of the study. Future investigations should focus on bioactivity-guided fractionation, isolation of active compounds, elucidation of molecular mechanisms, pharmacokinetic studies, long-term toxicity evaluation, and well-designed clinical trials to establish the therapeutic potential of Tecoma stans in human diabetes.

Overall, the present investigation provides convincing experimental evidence that the ethanolic leaf extract of Tecoma stans possesses significant antihyperglycaemic activity with an excellent safety profile. The antidiabetic effect is likely mediated through the synergistic action of flavonoids, alkaloids, tannins, phenolic compounds, and saponins, which collectively improve glucose homeostasis and protect pancreatic β-cells from oxidative damage. These findings scientifically validate the traditional medicinal use of Tecoma stans and support its further development as a promising phytopharmaceutical for the management of diabetes mellitus.

REFERENCES:

1. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: International Diabetes Federation; 2021.
2. American Diabetes Association. Standards of Care in Diabetes—2024. Diabetes Care. 2024;47(Suppl 1): S1–S350.
3. World Health Organization. Global Report on Diabetes. Geneva: WHO; 2016.
4. Harborne JB. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. 3rd ed. Chapman & Hall; 1998.
5. Trease GE, Evans WC. Trease and Evans Pharmacognosy. 16th ed. Elsevier; 2009.
6. Kokate CK. Practical Pharmacognosy. 5th ed. Vallabh Prakashan; 2014.
7. Khandelwal KR. Practical Pharmacognosy: Techniques and Experiments. 25th ed. Nirali Prakashan; 2019.
8. OECD. Guideline No. 423: Acute Oral Toxicity–Acute Toxic Class Method. Paris: OECD; 2001.
9. ICH. Q1A(R2): Stability Testing of New Drug Substances and Products. Geneva: International Council for Harmonisation; 2003.
10. ICH. Q2(R2): Validation of Analytical Procedures. Geneva: International Council for Harmonisation; 2023.
11. Rang HP, Ritter JM, Flower RJ, Henderson G. Rang and Dale's Pharmacology. 9th ed. Elsevier; 2020.
12. Katzung BG. Basic and Clinical Pharmacology. 16th ed. McGraw-Hill; 2021.
13. Ghosh MN. Fundamentals of Experimental Pharmacology. 7th ed. Hilton & Company; 2016.
14. Kulkarni SK. Handbook of Experimental Pharmacology. Vallabh Prakashan; 2012.
15. Vogel AI. Vogel's Textbook of Practical Organic Chemistry. 5th ed. Longman; 1989.
16. Szkudelski T. The mechanism of alloxan and streptozotocin action in β-cells of the rat pancreas. Physiol Res. 2001; 50:537–546.
17. Lenzen S. The mechanisms of alloxan and streptozotocin-induced diabetes. Diabetologia. 2008; 51:216–226.
18. Bailey CJ, Day C. Traditional plant medicines as treatments for diabetes. Diabetes Care. 1989; 12:553–564.
19. Grover JK, Yadav SP. Pharmacological actions and potential uses of medicinal plants in diabetes mellitus. J Ethno Pharmacol. 2002; 81:81–100.
20. Modak M, Dixit P, Londhe J, Ghaskadbi S, Devasagayam TPA. Indian herbs and herbal drugs used for the treatment of diabetes. J Clin Biochem Nutr. 2007; 40:163–173.
21. Eddouks M, Maghrani M, Lemhadri A, Ouahidi ML, Jouad H. Ethnopharmacological survey of medicinal plants used for diabetes mellitus. J Ethno Pharmacol. 2002; 82:97–103.
22. Marles RJ, Farnsworth NR. Antidiabetic plants and their active constituents. Phytomedicine. 1995; 2:137–189.
23. Li WL, Zheng HC, Bukuru J, De Kimpe N. Natural medicines used in traditional medicine for diabetes mellitus. J Ethno Pharmacol. 2004; 92:1–21.
24. Tundis R, Loizzo MR, Menichini F. Natural products as antidiabetic agents. Mini Rev Med Chem. 2010; 10:315–331.

25. Kooti W, Farokhipour M, Asadzadeh Z, Ashtary-Larky D, Asadi-Samani M. The role of medicinal plants in the treatment of diabetes: A systematic review. Electron Physician. 2016; 8:1832–1842.
26. Prabhakar PK, Doble M. Mechanism of action of natural products used in diabetes mellitus. Chin J Integr Med. 2011; 17:563–574.
27. Sofowora A. Medicinal Plants and Traditional Medicine in Africa. 3rd ed. Spectrum Books; 2008.
28. Evans WC. Trease and Evans Pharmacognosy. Saunders Elsevier; 2009.
29. CPCSEA. Guidelines for Laboratory Animal Facility. New Delhi; 2023.
30. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Ghaziabad; 2022.
31. Aguilar-Santamaría L, Ramírez G, Nicasio P, Alegría-Reyes C, Herrera-Arellano A. Antidiabetic activities of Tecoma stans (L.) Juss. ex Kunth. J Ethno Pharmacol. 2009; 124:284–288.
32. Alonso-Castro AJ, et al. Tecoma stans induces glucose uptake in insulin-sensitive and insulin-resistant adipocytes. J Ethno Pharmacol. 2010; 127:1–6.
33. Anand M, Basavaraj R. A review on phytochemistry and pharmacological uses of Tecoma stans (L.) Juss. ex Kunth. J Ethno Pharmacol. 2021; 265:113270.
34. Omar R, Elsbaey M, Hassan M, Abd El-Salam M. Exploring ethnomedicinal uses and relevance to phytochemical profile, pharmacological activities, and tissue culture of Tecoma stans. Phytomedicine Plus. 2025; 5:100800.
35. Balasubramanian B, Suresha BS, Ahalya Devi KH, Niveditha KH, Kathirvel D, Sharan R. A review on Tecoma stans Juss plant. Int J Pharmacogn. 2024.
36. Govindappa M, Sadananda TS, Channabasava R, Chandrappa CP. Phytochemical screening, antioxidant and antimicrobial activities of Tecoma stans. J Phytol. 2011; 3:68–76.
37. Krishna KL, Mruthunjaya K, Patel JA. Antioxidant and phytochemical evaluation of Tecoma stans. Int J Pharma Bio Sci. 2010; 1:1–8.
38. Salem MZM, Salem AZM, Camacho LM, Ali HM. Antimicrobial and antioxidant activities of Tecoma stans extracts. Afr J Pharm Pharmacol. 2013; 7:1486–1493.
39. Chinsembu KC. Diabetes mellitus and nature's pharmacy of putative antidiabetic plants. J Herb Med. 2019; 15:100230.
40. Pandey A, Tripathi S. Concept of standardization, extraction and phytochemical screening of herbal drugs. J Pharmacogn Phytochem. 2014; 2:115–119.
41. Costantino L, Raimondi L, Pirisino R, Brunetti T, Pessotto P, Giannessi F. Isolation and pharmacological activities of Tecoma stans alkaloids.
42. Hammouda Y, Khalafallah N. Antidiabetic effect of tecomine and tecostanine.
43. Hammouda Y, Khalafallah N. Stability of tecomine, the major antidiabetic factor of Tecoma stans.
44. Dickinson EM, Jones G. Pyrindane alkaloids from Tecoma stans.
45. Bianco A, et al. New iridoids isolated from Tecoma stans.
46. Lozoya X, Meckes M. Traditional use of Tecoma stans in Mexican medicine.
47. Hernández-Galicia E, et al. Antihyperglycaemic activity of medicinal plants used in Mexican traditional medicine.
48. Pérez RM, Ocegueda A, Muñoz JL, Ávila JG, Morrow WW. Pharmacological evaluation of Tecoma stans extracts.
49. Naranjo M, et al. Hypoglycaemic evaluation of Tecoma stans.
50. K. Pavan Kumar and M. Kannadasan. Therapeutic Horizons of Autophagy and Apoptosis in Colorectal Cancer: A Translational Perspective from Molecules to Medicine. International Journal of Pharmaceutical Biological and Chemical Sciences. 2025 14(1): 36-46. 103.
51. K. Pavan Kumar and M. Kannadasan. Intermittent Fasting and The Multifaceted Role of Beclin-1 and Bcl-2 In Regulating Autophagy and Apoptosis in Colorectal Cancer. Journal of Chemical and Pharmaceutical Sciences. 2025 18 (2): 103-114.
52. Costantino L, et al. Pharmacological evaluation of Pyrindane alkaloids from Tecoma stans.
53. DeFronzo RA, Ferrannini E, Zimmet P, Alberti G. International Textbook of Diabetes Mellitus. 5th ed.
54. Brunton LL, Hilal-Dandan R, Knoll Mann BC. Goodman & Gilman's The Pharmacological Basis of Therapeutics. 14th ed.
55. Kumar V, Abbas AK, Aster JC. Robbins and Cotran Pathologic Basis of Disease. 10th ed.
56. Dipiro JT, Yee GC, Posey LM. Pharmacotherapy: A Pathophysiologic Approach. 12th ed.
57. Patel DK, Kumar R, Laloo D, Hemalatha S. Diabetes mellitus: An overview on its pharmacological aspects.
58. Bhatia R, Sharma K, Gupta A. Advances in phytopharmaceutical approaches for diabetes management. J Herb Med. 2023.
59. International Diabetes Federation. Diabetes and cardiovascular disease factsheet.

60. American Diabetes Association. Pharmacologic approaches to glycaemic treatment. Diabetes Care. 2024.
61. K. Pavan Kumar and Amit Kumar. Modulation Of Beclin-1 and Bcl-2 Expression by Intermittent Fasting In CRC: Links to Autophagy and Apoptosis. International Journal of Pharmacy and Biological Sciences. 2025 15 (4): 91-115.
62. K. Pavan Kumar and Amit Kumar. Intermittent Fasting-Induced Autophagy and Apoptosis in Colorectal Carcinoma: The Role of Beclin-1 and Bcl-2. International Journal of Pharmaceutical Biological and Chemical Sciences. 2025 14 (4): 26-38.
63. Kokkula PavanKumar, Rajeev Imadi, Prasad Garrepally, S Nikitha Anthelmintic Activity of Some Medicinal Plants: A Short Review, International Journal of Pharmacy and Biological Sciences,9(2):605 611(2019).
64. Kokkula Pavan Kumar, Ampati Srinivas and Prasad Garrepally, Hyperthermia has consistently improved the efficacy of radiotherapy and chemotherapy for many types of cancers, Journal of Stem cell Research and Therapeutics International, 1(003):1-3(2019).
65. Kokkula Pavan Kumar, Ampati Srinivas and Prasad Garrepally, Subcutaneous DL technique has proven to be an adequate host for human embryonic stem cells, Journal of Stem cell Research and Therapeutics International, 1(004):1-3(2019).
66. Kokkula Pavan Kumar, Boda Rambabu, Investigational studies on carcinoma in male SD rats, International Journal of Research and Analytical Reviews,6(2):654-662(2019).
67. K. Pavan Kumar, G. Venkateshwarlu, Navaneeth Kumar, Mukesh Sharma, Rekha Pal, Taniya Rawat, E. Rajeswari, Wound healing activity of Indian Medicinal Plants, High Technology Letters, 28(2):1 7(2022).
68. K. Pavan Kumar, G. Venkateshwarlu, Mukesh Chandra Sharma, Govind pal, Rekha pal, Taniya Rawat, Invitro anthelmintic activity of alcoholic and methanolic extracts of seeds of Panicum miliaceum in Indian adult earthworm, High Technology Letters, 28(1): 800 809(2022).
69. World Health Organization. WHO Traditional Medicine Strategy 2025.
70. Anand M, Basavaraj R. Ecology, phytochemistry and therapeutic potential of Tecoma stans.
71. Recommendation for publication
72. Anand M, Basavaraj R. A review on phytochemistry and pharmacological uses of *Tecoma stans* (L.) Juss. ex Kunth. *J Ethno Pharmacol*. 2021; 265:113270.
73. Khattab A, Awed NE, Abdel Fadel D, Fadel M. Reviewing the reported pharmacognostic and pharmacological investigations on *Tecoma stans* Juss. ex Kunth. *J Herbmed Pharmacol*. 2023;12(1):25–40.
74. Omar R, Elsbaey M, Hassan M, Abd El-Salam M. Exploring ethnomedicinal uses and relevance to phytochemical profile, pharmacological activities, and tissue culture of *Tecoma stans* (L.) Juss. ex Kunth. *Phytomedicine Plus*. 2025;5(2):100800.
75. Aguilar-Santamaría L, Ramírez G, Nicasio P, Alegría-Reyes C, Herrera-Arellano A. Antidiabetic activities of *Tecoma stans* (L.) Juss. ex Kunth. *J Ethno Pharmacol*. 2009;124(2):284–288.
76. Alonso-Castro AJ, Villarreal ML, Salazar-Olivo LA, et al. *Tecoma stans* induces glucose uptake in insulin-sensitive and insulin-resistant adipocytes. *J Ethno Pharmacol*. 2010; 127:1–6.
77. Costantino L, Raimondi L, Pirisino R, Brunetti T, Pessotto P, Giannessi F. Isolation and pharmacological activities of hypoglycaemic alkaloids from *Tecoma stans*. *Phytotherapy Research*.
78. Hammouda Y, Khalafallah N. Hypoglycaemic activity of tecomine isolated from *Tecoma stans*. *Journal of Natural Products*.
79. Hammouda Y, Khalafallah N. Stability studies on tecomine, the principal antidiabetic alkaloid of *Tecoma stans*. *Planta Medica*.
80. Dickinson EM, Jones G. Pyrindane alkaloids isolated from *Tecoma stans*. *Phytochemistry*.
81. Bianco A, Passacantilli P, Righi G, et al. Isolation and characterization of iridoid glycosides from *Tecoma stans*. *Phytochemistry*.
82. Ramírez G, Zamilpa A, Tortoriello J, Herrera-Arellano A. Bioactive compounds responsible for the hypoglycaemic activity of *Tecoma stans*. *Fitoterapia*.
83. Hernández-Galicia E, Aguilar-Contreras A, Aguilar-Santamaría L, et al. Studies on antihyperglycaemic medicinal plants used in Mexican traditional medicine. *J Ethno Pharmacol*.
84. Rodríguez de Sotillo DV, Hadley M. Chlorogenic acid modifies glucose metabolism and improves insulin sensitivity. *J Nutr Biochem*.
85. Ramírez G, Zavala M, Pérez J, Zamilpa A. Pancreatic lipase inhibitory flavonoids isolated from *Tecoma stans*. *Phytochemistry*.
86. Govindappa M, Sadananda TS, Channabasava R, Chandrappa CP. Phytochemical screening, antioxidant and antimicrobial activities of *Tecoma stans*. *J Phytol*. 2011;3(3):68–76.
87. Krishna KL, Mruthunjaya K, Patel JA. Antioxidant and phytochemical evaluation of

Tecoma stans leaves. *Int J Pharm Bio Sci*. 2010;1(2):1–8.
88. Salem MZM, Salem AZM, Camacho LM, Ali HM. Antimicrobial and antioxidant activities of *Tecoma stans* extracts. *Afr J Pharm Pharmacol*. 2013;7(21):1486–1493.
89. Chinsembu KC. Diabetes mellitus and nature's pharmacy of putative antidiabetic plants. *J Herb Med*. 2019; 15:100230.
90. Bhat MA. Remedial and phytochemical review study on *Tecoma stans*. *Innovare Journal of Life Sciences*. 2019;7(4):1–6.
91. Balasubramanian B, Suresha BS, Ahalya Devi KH, Niveditha KH, Kathirvel D, Sharan R. A review on *Tecoma stans* Juss. *International Journal of Pharmacognosy*. 2024