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Research Article

Evaluation of the Antidiabetic Potential of Aqueous Extract of Sansevieria Trifasciata in Streptozotocin-Induced Diabetic Wistar Rats

Shreshth Singhal * and Manoj Sharma

School of Pharmaceutical Sciences, Jiwaji University, Gwalior, Madhya Pradesh, India

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For Correspondence:

Shreshth Singhal, School of Pharmaceutical Sciences, Jiwaji University, Gwalior, Madhya Pradesh, India

Abstract

Background Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, impaired insulin action, or both. Prolonged hyperglycemia is associated with multiple systemic complications and represents a major global health concern. Increasing attention has been directed toward medicinal plants and their bioactive constituents as potential sources of complementary and alternative approaches for diabetes management. **Aim** The present study was undertaken to evaluate the antidiabetic potential of an aqueous leaf extract of *Sansevieria trifasciata* in streptozotocin-induced diabetic Wistar rats. **Materials and Methods** Fresh leaves of *Sansevieria trifasciata* were collected, authenticated, shade-dried, powdered, and extracted using an aqueous decoction method. Preliminary qualitative phytochemical screening was performed to identify major phytochemical constituents. Adult Wistar albino rats weighing 180–220 g were divided into five groups of six animals each: normal control, diabetic control, standard drug-treated group, and two extract-treated groups receiving 1800 and 3600 mg/kg, respectively. Experimental diabetes was induced by intraperitoneal administration of streptozotocin at a dose of 40 mg/kg body weight. Fasting blood glucose levels were assessed at predetermined intervals during the 14-day treatment period. Changes in body weight and serum lipid parameters were also evaluated. Data were expressed as mean ± SEM and analyzed using appropriate statistical methods, with $p \leq 0.05$ considered statistically significant. **Results** Preliminary phytochemical screening of the aqueous leaf extract revealed the presence of flavonoids, saponins, tannins, alkaloids, glycosides, and steroidal/triterpenoid constituents, whereas anthraquinones were not detected. Streptozotocin administration produced marked hyperglycemia in the experimental animals. Treatment with the aqueous extract resulted in a progressive reduction in blood glucose levels, with the 3600 mg/kg dose producing a greater reduction than the 1800 mg/kg dose. At Day 14, blood glucose levels were 145.01 ± 2.0 mg/dL and 95.02 ± 2.0 mg/dL in the 1800 and 3600 mg/kg extract groups, respectively, compared with 72.29 ± 1.6 mg/dL in the glibenclamide-treated group. Extract-treated animals also showed improvement in body-weight changes compared with diabetic control animals. **Conclusion** The aqueous leaf extract of *Sansevieria trifasciata* demonstrated promising antihyperglycemic activity in streptozotocin-induced diabetic Wistar rats. The activity may be associated with the phytochemical constituents present in the extract. Further studies involving detailed biochemical, molecular, and mechanistic investigations are required to establish its therapeutic potential and mechanism of action.

Keywords: *Sansevieria trifasciata*; diabetes mellitus; streptozotocin; Wistar rats; aqueous extract; phytochemicals; antihyperglycemic activity.

1. Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, impaired insulin action, or both. The disorder affects carbohydrate, lipid, and protein metabolism and represents a major global health concern because of its increasing prevalence and associated complications. Prolonged uncontrolled hyperglycemia may contribute to cardiovascular disease, nephropathy, neuropathy, retinopathy, and other systemic complications.[1]

According to the World Health Organization (WHO), the global burden of diabetes has increased substantially over recent decades. The number of adults living with diabetes has increased markedly worldwide, with type 2 diabetes mellitus accounting for the majority of diabetes cases.[2]

Current approaches to diabetes management include lifestyle modification, insulin therapy, and oral antidiabetic agents such as biguanides and sulfonylureas. Although these therapies can effectively control blood glucose levels, their use may be associated with adverse effects, inadequate glycemic control in some patients, and economic burden. Consequently, increasing attention has been directed toward medicinal plants and naturally occurring phytoconstituents as potential sources of therapeutic agents for diabetes management.[3]

Medicinal plants contain a wide variety of biologically active constituents, including flavonoids, alkaloids, glycosides, tannins, saponins, and terpenoids. These compounds may contribute to antihyperglycemic activity through several mechanisms, including antioxidant activity, enhancement of insulin secretion, improvement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, and modulation of glucose metabolism.[4]

Sansevieria trifasciata (family Asparagaceae), commonly known as snake plant or mother-in-law's tongue, is a perennial medicinal plant traditionally associated with several therapeutic applications. Phytochemical investigations of *S. trifasciata* have reported the presence of several classes of secondary metabolites, including flavonoids, saponins, tannins, glycosides, alkaloids, and steroidal constituents.[5,8,9] These phytoconstituents may contribute to the pharmacological activities reported for the plant.

Streptozotocin (STZ)-induced diabetes is a commonly used experimental model for investigating potential antidiabetic agents. Streptozotocin produces pancreatic β-cell injury through mechanisms involving DNA damage, oxidative stress, and subsequent impairment of insulin production, resulting in persistent hyperglycemia.[6]

Although *S. trifasciata* has been investigated for phytochemical and other pharmacological properties, scientific information concerning the antidiabetic potential of its aqueous leaf extract remains limited. Previous investigations have mainly focused on phytochemical characterization and antimicrobial or antioxidant activities.[8,9] Therefore, further experimental investigation is warranted to determine whether the aqueous leaf extract can exert beneficial effects under diabetic conditions.

The present study was therefore designed to evaluate the antidiabetic potential of an aqueous extract of *S. trifasciata* leaves in streptozotocin-induced diabetic Wistar rats by assessing changes in blood glucose levels, body weight, and serum lipid parameters.

2. Materials and Methods

2.1 Plant Collection and Authentication

Fresh leaves of *Sansevieria trifasciata* were procured from a local market in Gwalior, Madhya Pradesh, India. The plant material was authenticated by a qualified taxonomist at the Botanical Survey of India, Botanic Garden of Indian Republic, Noida. A herbarium specimen was prepared and submitted for botanical verification (BSI/BGIR/I/TECH./2025/237).

2.2 Preparation of Aqueous Extract

The collected leaves were thoroughly washed with water, cut into small pieces, and shade-dried at room temperature. The dried material was pulverized into coarse powder using a mechanical grinder and stored in an airtight container until extraction.

For preparation of the aqueous extract, approximately 80 g of dried leaf powder was mixed with 350 mL of distilled water and heated continuously for approximately 3–3.5 h with intermittent stirring. The resulting decoction was allowed to cool and was subsequently filtered. The filtrate was collected and concentrated appropriately to obtain the aqueous extract.

2.3 Preliminary Phytochemical Screening

Preliminary qualitative phytochemical screening of the aqueous extract of *S. Trifasciata* leaves was performed using standard phytochemical procedures to determine the presence of major classes of secondary metabolites.

2.3.1 Saponins — Foam Test

The extract was dissolved in distilled water and shaken vigorously. The formation of persistent and stable foam for approximately 15 min was considered indicative of the presence of saponins.

2.3.2 Cardiac Glycosides — Keller–Killiani Test

The extract solution was treated with glacial acetic acid and ferric chloride solution, followed by careful addition of concentrated sulfuric acid. The development of a characteristic reddish-brown ring at the interface was considered indicative of cardiac glycosides.

2.3.3 Flavonoids — Alkaline Reagent Test

The extract was treated with sodium hydroxide solution. The development of an intense yellow coloration that disappeared upon addition of dilute hydrochloric acid indicated the presence of flavonoids.

2.3.4 Alkaloids — Dragendorff's Test

The extract was dissolved in dilute hydrochloric acid and filtered. The filtrate was treated with Dragendorff's reagent. Formation of a reddish-brown precipitate indicated the possible presence of alkaloids.

2.3.5 Steroids and Triterpenoids — Salkowski Test

The extract was treated with chloroform and concentrated sulfuric acid. Characteristic color development at the interface was used to indicate the possible presence of steroids and/or triterpenoids.

2.3.6 Tannins and Phenolic Compounds — Ferric Chloride Test

The extract solution was treated with ferric chloride solution. Development of a greenish-black coloration indicated the presence of tannins and phenolic compounds.

2.4 Preparation of Drugs and Dosing

2.4.1 Streptozotocin

Streptozotocin (98% purity) was freshly prepared in 0.9% Saline immediately before administration and administered intraperitoneally at a dose of 40 mg/kg body weight.

2.4.2 Standard Drug

Glibenclamide was freshly prepared in the selected vehicle and administered at a dose of 0.25 mg/kg body weight.

2.4.3 Extract Administration

The aqueous extract of *S. Trifasciata* was freshly prepared in distilled water and administered orally at doses of 1800 mg/kg and 3600 mg/kg body weight once daily throughout the 14-day treatment period.

2.5 Acute Toxicity Assessment

Based on previously reported literature, the aqueous leaf extract of *S. trifasciata* was reported to have a relatively high acute toxicity threshold, with an estimated LD_{50} of approximately 18,000 mg/kg body weight. The doses selected for the present study were therefore substantially below the reported LD_{50}.

2.6 Experimental Animals and Ethical Approval

Adult Wistar albino rats weighing 180–220 g were used for the study. Animals were maintained under standard laboratory conditions at approximately 25°C with a 12 h light/12 h dark cycle. Standard pellet diet and water were provided *ad libitum* throughout the experimental period.

All experimental procedures involving animals were conducted in accordance with applicable institutional and animal ethical guidelines and were approved by the Institutional Animal Ethics Committee.

2.7 Induction of Experimental Diabetes

Experimental diabetes was induced in overnight-fasted Wistar albino rats by a single intraperitoneal administration of freshly prepared streptozotocin at a dose of 40 mg/kg body weight.

Fasting blood glucose levels were subsequently measured to confirm the establishment of diabetes. Animals showing fasting blood glucose levels greater than 200 mg/dL were considered diabetic and included in the study.

2.8 Experimental Design and Animal Grouping

Following confirmation of diabetes, the animals were randomly divided into five groups, with six animals in each group (n = 6).

Group I — Normal Control: Healthy rats receiving the vehicle.

Group II — Diabetic Control: Streptozotocin-induced diabetic rats receiving no antidiabetic treatment.

Group III — Standard Treatment: Streptozotocin-induced diabetic rats treated with glibenclamide (0.25 mg/kg, orally) once daily for 14 days.

Group IV — Low-Dose Extract: Streptozotocin-induced diabetic rats treated with aqueous extract of *S. trifasciata* (1800 mg/kg, orally) once daily for 14 days.

Group V — High-Dose Extract: Streptozotocin-induced diabetic rats treated with aqueous extract of *S. trifasciata* (3600 mg/kg, orally) once daily for 14 days.

2.9 Evaluation of Blood Glucose Levels

Fasting blood glucose levels were determined at baseline and following induction of diabetes. Blood samples were collected from the tail vein on Days 3, 7, and 14 of treatment.

Serum glucose concentration was estimated using a glucose oxidase–peroxidase enzymatic method with commercially available diagnostic kits. Absorbance was measured at 510 nm using a UV–Visible spectrophotometer, and glucose concentrations were expressed as mg/dL.

2.10 Body Weight Measurement

The body weight of each animal was recorded at the beginning of the experimental period (Day 0) and at the end of the treatment period (Day 14). Changes in body weight were calculated to evaluate the effect of diabetes induction and treatment on body-weight status.

2.11 Lipid Profile Analysis

After overnight fasting, blood samples were collected and allowed to clot at room temperature. Serum was separated by centrifugation and used for biochemical analysis.

Serum total cholesterol was estimated using an enzymatic colorimetric method based on cholesterol oxidase. Serum triglycerides were estimated using the glycerol phosphate oxidase method. HDL-C was determined using a precipitation-based method, while LDL-C was calculated using the Friedewald formula.

2.12 Statistical Analysis

Data were expressed as mean ± SEM for six animals per group (n = 6). Statistical analysis was performed using Student's *t*-test and/or one-way analysis of variance (ANOVA), followed by an appropriate post hoc multiple-comparison test where applicable. Differences were considered statistically significant at $p \leq 0.05$.

3. Results

3.1 Preliminary Phytochemical Screening

Preliminary qualitative phytochemical analysis of the aqueous extract of *S. trifasciata* leaves revealed the presence of flavonoids, saponins, tannins, alkaloids, glycosides, and steroidal/triterpenoid constituents. Anthraquinones were not detected in the extract (Table 1).

Table 1. Preliminary phytochemical profile of the aqueous leaf extract of *Sansevieria trifasciata*

S. No.	Phytochemical constituent	Result
1	Flavonoids	++
2	Saponins	++
3	Tannins	++
4	Alkaloids	++
5	Glycosides	++
6	Terpenoids/Steroids	++
7	Anthraquinones	–

Note: ++ indicates moderate presence; – indicates absence. The scoring system should be defined according to the method actually used.

3.2 Effect of Streptozotocin on Blood Glucose Levels

Administration of streptozotocin at 40 mg/kg produced marked hyperglycemia in Wistar rats. The blood glucose level recorded after diabetes induction was 270.10 ± 9.4 mg/dL in diabetic animals compared with 71.56 ± 3.0 mg/dL in normal control animals. Treatment with glibenclamide and the aqueous extract of *S. trifasciata* reduced blood glucose levels compared with diabetic control animals. The reduction was more pronounced in animals receiving the higher extract dose of 3600 mg/kg.

Table 2. Blood glucose levels following induction of diabetes

Group	Blood glucose level (mg/dL)
Normal control	71.56 ± 3.0
Diabetic control	270.10 ± 9.4
Glibenclamide	144.04 ± 7.2
S. trifasciata extract (1800 mg/kg)	234.03 ± 7.5
S. trifasciata extract (3600 mg/kg)	198.08 ± 6.9

3.3 Effect of *Sansevieria trifasciata* Extract on Blood Glucose Levels

The aqueous extract produced a progressive reduction in blood glucose levels during the 14-day treatment period.

Diabetic control animals showed persistent hyperglycemia, whereas treatment with glibenclamide and the aqueous extract resulted in a gradual reduction in blood glucose concentration.

At Day 14, the blood glucose concentration was 72.29 ± 1.6 mg/dL in the glibenclamide-treated group. Animals treated with the aqueous extract at 1800 and 3600 mg/kg showed glucose concentrations of 145.01 ± 2.0 mg/dL and 95.02 ± 2.0 mg/dL, respectively.

The greater reduction observed with the 3600 mg/kg dose suggests a dose-related antihyperglycemic effect of the aqueous extract.

Table 3. Effect of aqueous extract of *Sansevieria trifasciata* on blood glucose levels in streptozotocin-induced diabetic Wistar rats

Group	Day 0	Day 3	Day 7	Day 14
Normal control	72.46 ± 4.0	72.01 ± 3.1	71.14 ± 2.9	70.22 ± 2.9
Diabetic control	258.20 ± 14.0	263.05 ± 12.5	278.80 ± 8.2	289.49 ± 9.8
Glibenclamide	293.02 ± 18.50	250.02 ± 15.5	72.15 ± 1.4	72.29 ± 1.6
S. trifasciata extract (1800 mg/kg)	298.02 ± 15.07	280.05 ± 11.2	198.02 ± 3.5	145.01 ± 2.0
S. trifasciata extract (3600 mg/kg)	302.01 ± 16.0	265.06 ± 10.6	150.04 ± 3.6	95.02 ± 2.0

3.4 Effect of *Sansevieria trifasciata* Extract on Body Weight

Diabetic control animals showed a reduction in body-weight gain relative to normal control animals. Treatment with glibenclamide and the aqueous extract was associated with stabilization or improvement in body-weight changes.

The normal control group showed an increase of approximately 40.5 g during the experimental period. The extract-treated groups showed comparatively smaller changes in body weight. The 3600 mg/kg group showed a slightly greater increase than the 1800 mg/kg group.

Table 4. Effect of aqueous extract of *Sansevieria trifasciata* on body weight of experimental animals

Group	Day 0 (g)	Day 14 (g)	Change (g)
Normal control	165.83 ± 15.17	206.33 ± 14.52	+40.50
Diabetic control	216.66 ± 14.75	231.66 ± 15.25	+15.00
Glibenclamide	236.66 ± 15.25	240.66 ± 15.20	+4.00
S. trifasciata extract (1800 mg/kg)	242.66 ± 15.33	243.66 ± 15.33	+1.00
S. trifasciata extract (3600 mg/kg)	244.66 ± 15.33	245.83 ± 15.22	+1.17

4. Discussion

The present study evaluated the antidiabetic potential of an aqueous leaf extract of *Sansevieria trifasciata* in streptozotocin-induced diabetic Wistar rats. The findings demonstrated that the extract produced a reduction in blood glucose levels during the 14-day treatment period, with the 3600 mg/kg dose showing a greater antihyperglycemic effect than the 1800 mg/kg dose.

The development of hyperglycemia following administration of streptozotocin confirms the suitability of the experimental model for evaluating antihyperglycemic activity. Streptozotocin is known to produce pancreatic β-cell injury and consequently impair insulin availability, resulting in elevated blood glucose levels.[6] In the present study, diabetic control animals maintained high blood glucose concentrations throughout the experimental period, supporting successful establishment and maintenance of the diabetic condition.

Treatment with the aqueous extract resulted in a progressive reduction in blood glucose concentration. The effect was more pronounced at the higher dose of 3600 mg/kg, suggesting a possible dose-dependent antihyperglycemic response. At Day 14, the 3600 mg/kg group showed a glucose concentration of 95.02 ± 2.0 mg/dL, whereas the 1800 mg/kg group showed 145.01 ± 2.0 mg/dL. Although the higher-dose extract did not produce a glucose concentration identical to that observed with glibenclamide, the reduction indicates appreciable antihyperglycemic potential.

The observed activity may be associated with the phytochemical constituents detected in the aqueous extract. Flavonoids, saponins, tannins, alkaloids, glycosides, and steroidal/triterpenoid constituents were detected during preliminary phytochemical screening. Several classes of plant-derived phytochemicals have been investigated for their possible effects on glucose metabolism, insulin sensitivity, oxidative stress, and carbohydrate digestion.[4] Therefore, the combined presence of these constituents may contribute to the observed reduction in blood glucose levels.

The phytochemical findings are also consistent with previous reports describing the presence of biologically active constituents in *S. trifasciata*.[8,9] The antioxidant and other pharmacological properties reported for this plant provide a possible basis for further investigation of its metabolic effects. However, the present phytochemical screening was qualitative and therefore does not establish which individual constituent is responsible for the observed antihyperglycemic activity.

Changes in body weight were also observed during the experimental period. Diabetes is frequently associated with disturbances in carbohydrate utilization and alterations in protein and lipid metabolism. The diabetic control group showed a lower improvement in body-weight status than the normal control group. Treatment groups showed stabilization of body weight during the experimental period. These observations may indicate an improvement in metabolic status following treatment; however, body weight alone cannot establish a specific mechanism of antidiabetic action.

The greater response observed with the 3600 mg/kg extract compared with the 1800 mg/kg dose suggests that the antihyperglycemic activity may be dose-related within the dose range investigated. Nevertheless, dose-response relationships should be interpreted cautiously because only two extract doses were evaluated.

The present findings provide preliminary experimental evidence supporting the antidiabetic potential of the aqueous leaf extract of *S. trifasciata*. However, several limitations should be considered. The study primarily evaluated blood glucose and body-weight changes, while detailed assessment of insulin levels, pancreatic histopathology, oxidative stress markers, glucose tolerance, and relevant molecular pathways was not included in the presented data. Furthermore, qualitative phytochemical screening does not permit identification or quantification of the individual compounds responsible for the observed activity. Future studies should therefore investigate the active constituents, insulin-related mechanisms, pancreatic tissue changes, antioxidant parameters, and long-term safety of the extract.

5. Conclusion

The present study demonstrated that the aqueous leaf extract of *Sansevieria trifasciata* possesses promising antihyperglycemic activity in streptozotocin-induced diabetic Wistar rats. The extract produced a progressive reduction in blood glucose levels, with the 3600 mg/kg dose showing greater activity than the 1800 mg/kg dose. The phytochemical screening indicated the presence of several classes of secondary metabolites that may contribute to the observed pharmacological effect.

Although these findings support the potential of *S. trifasciata* as a source of antidiabetic phytoconstituents, further investigations involving detailed biochemical, histopathological, molecular, pharmacokinetic, and toxicity studies are required before any therapeutic conclusions can be established.

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Author Contributions

Shreshth Singhal: Conceptualization, methodology, investigation, data collection, data analysis, and manuscript preparation.

Manoj Sharma: Supervision, study design, interpretation of findings, critical review, and final approval of the manuscript.

All authors reviewed and approved the final version of the manuscript.

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Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical Approval: The experimental protocol involving laboratory animals was reviewed and approved by the Institutional Animal Ethics Committee of Jiwaji University, Gwalior. The study was conducted in accordance with applicable institutional and ethical guidelines for the care and use of laboratory animals.

References

1. American Diabetes Association Professional Practice Committee. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2024;47(Suppl 1):S20-S42.
2. World Health Organization. Diabetes fact sheet. Geneva: World Health Organization; 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes
3. Katzung BG, Vanderah TW. Basic and Clinical Pharmacology. 16th ed. New York: McGraw Hill; 2021. p. 745-772.
4. 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(3):163-173. https://doi.org/10.3164/jcbn.40.163 PMid:18398493 PMCid:PMC2275761
5. Plant-based diets and phytochemicals in diabetes management and prevention of complications. Nutrients. 2024.
6. Srinivasan K, Viswanad B, Asrat L, Kaul CL, Ramarao P. Combination of high-fat diet-fed and low-dose streptozotocin-treated rat: a model for type 2 diabetes and pharmacological screening. Pharmacol Res. 2005;52(4):313-320. https://doi.org/10.1016/j.phrs.2005.05.004 PMid:15979893
7. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: International Diabetes Federation; 2021.
8. Sheela D, Uthayakumari F. Phytochemical screening and antimicrobial activity of Sansevieria trifasciata Prain. Int J Pharm Pharm Sci. 2013;5(Suppl 3):783-785.
9. Ntcha EF, Fankam AG, Mbaveng AT, Kuete V. Antioxidant and antimicrobial activities of Sansevieria trifasciata. BMC Complement Med Ther. 2016;16:1-9.