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# Antidiabetic and Anti-inflammatory activities of Hydroalcoholic Flower Extract of *Sphagneticola trilobata*

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## ABSTRACT

Diabetes mellitus and inflammation are among the most prevalent chronic disorders worldwide, creating a growing need for safer and more effective therapeutic agents. Medicinal plants have gained significant attention due to their rich phytochemical composition and broad pharmacological activities. The present study aimed to evaluate the in vitro antidiabetic and anti-inflammatory activities of the hydroalcoholic flower extract of Sphagneticola trilobata. Fresh flowers were collected, shade-dried, and extracted using 70% ethanol by the Soxhlet extraction method. The obtained extract showed a percentage yield of 8.24% and was subjected to preliminary phytochemical screening, which confirmed the presence of flavonoids, glycosides, tannins, triterpenes, steroids, carbohydrates, and reducing sugars. The anti-inflammatory activity was assessed by the nitric oxide (NO) inhibition assay using RAW 264.7 macrophage cells, while the antidiabetic activity was evaluated by the glucose utilization assay using HepG2 cell lines, with metformin serving as the standard drug. The extract exhibited dose-dependent anti-inflammatory activity, achieving 69.90% NO inhibition at 100 µg/mL, and demonstrated significant enhancement of glucose utilization, reaching 166.19% of control at 100µg/mL. These findings indicate promising anti-inflammatory and antidiabetic potential, which may be attributed to the synergistic action of the phytoconstituents present in the extract.

**Keywords:** Diabetes mellitus, Inflammation, Sphagneticola trilobata, Flavonoids, Nitric oxide inhibition, HepG2 cells, Glucose utilization

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## INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin action, or both. It is one of the fastest-growing non-communicable diseases worldwide and represents a major public health challenge due to its increasing prevalence and associated complications. Chronic hyperglycemia leads to oxidative stress, inflammation, endothelial dysfunction, and metabolic disturbances, ultimately contributing to microvascular complications such as nephropathy, retinopathy, and neuropathy, as well as macrovascular complications including cardiovascular diseases.[1,2]

Inflammation plays a crucial role in the initiation and progression of diabetes and its complications. Persistent activation of inflammatory pathways and excessive production of pro-inflammatory cytokines impair insulin signaling, promote insulin resistance, and accelerate pancreatic β-cell dysfunction. Therefore, therapeutic agents possessing both antidiabetic and anti-inflammatory properties are considered promising candidates for the management of diabetes and its associated complications.[3,4]

Medicinal plants have long been recognized as valuable sources of bioactive compounds with therapeutic potential. Phytochemicals such as flavonoids, phenolic compounds, terpenoids, alkaloids, saponins, and tannins exhibit antihyperglycemic, antioxidant, and anti-inflammatory activities through multiple mechanisms, including enhancement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, reduction of oxidative stress, suppression of inflammatory mediators, and protection of pancreatic β-cells.[5,6] Consequently, there is increasing scientific interest in validating traditionally used medicinal plants as safer and cost-effective alternatives or complementary therapies for diabetes management.

*Sphagneticola trilobata* (L.) Pruski (syn. *Wedelia trilobata*), a perennial creeping herb belonging to the family Asteraceae, is widely distributed in tropical and subtropical regions. Traditionally, the plant has been used for the treatment of wounds, fever, inflammatory disorders, skin diseases, and liver ailments. Phytochemical investigations have demonstrated the presence of flavonoids, phenolic acids, terpenoids, alkaloids, saponins, and tannins, which are responsible for its diverse pharmacological activities.[7,8]

Previous studies have reported significant anti-inflammatory activity of *S. trilobata* leaf extracts in experimental animal models, antimicrobial activity against several pathogenic microorganisms, hepatoprotective and analgesic effects, as well as antioxidant and antidiabetic properties of crude plant extracts.[9–13] However, most investigations have focused on the aerial parts or whole plant, while the pharmacological potential of the flowers remains largely unexplored. Since flowers are

known to contain considerable amounts of flavonoids and phenolic compounds, they may serve as an important source of bioactive molecules with therapeutic value.

Therefore, the present study aimed to investigate the phytochemical constituents and evaluate the *in vitro* antidiabetic and anti-inflammatory activities of the hydroalcoholic flower extract of *Sphagneticola trilobata***.** The findings of this study may provide scientific evidence supporting its traditional medicinal use and contribute to the development of novel plant-derived therapeutic agents for the management of diabetes and inflammatory disorders.

## MATERIALS AND METHOD

### Plant Collection and Authentication

Fresh flowers of *Sphagneticola trilobata* (L.) Pruski (Family: Asteraceae) were collected from the campus of Guru Nanak Institutions Technical Campus, Hyderabad, India. The plant was identified based on its morphological characteristics and authenticated by Dr. Vijaya Bhasker Reddy, Department of Botany, Osmania University, Hyderabad. A voucher herbarium specimen (Specimen No: OUAS-371) was prepared and deposited for future reference.

### Preparation of Plant Extract

The collected flowers were shade-dried at room temperature and coarsely powdered. Approximately 500 g of the dried powder was extracted with 70% ethanol using a Soxhlet apparatus for 8 h. The extract was concentrated under reduced pressure by distillation to recover the solvent and obtain a semi-solid crude extract, which was stored in an airtight container at 4°C until further use. The extract was subsequently subjected to preliminary phytochemical screening and biological evaluation.

### Preliminary Phytochemical Screening

The hydroalcoholic flower extract was qualitatively screened for major phytochemical constituents using standard phytochemical methods. The tests included detection of alkaloids (Dragendorff's, Mayer's, Wagner's and Hager's tests), carbohydrates (Molisch's, Benedict's, Fehling's and iodine tests), proteins (Biuret and Ninhydrin tests), flavonoids (Lead acetate, Ferric chloride, Shinoda and alkaline reagent tests), glycosides (Keller-Killiani, Legal's, Borntrager's, Foam, Hemolysis and Sodium picrate tests), steroids and triterpenoids (Liebermann-Burchard, Salkowski and Antimony trichloride tests), lipids (Sudan III, Emulsion and Saponification tests), and tannins (Lead acetate and Matchstick tests).

### *In vitro* Anti-inflammatory Activity

The anti-inflammatory activity of the extract was evaluated by measuring inhibition of nitric oxide (NO) production in RAW 264.7 murine macrophage cells using the Griess assay. Cells were

cultured in Dulbecco's Modified Eagle Medium (DMEM) supplemented with 10% fetal bovine serum, penicillin (50 U/mL) and streptomycin (50 µg/mL) at 37°C in a humidified atmosphere containing 5% $CO_2$.

RAW 264.7 cells were seeded at a density of $2 \times 10^5$ cells/well in 96-well plates and allowed to adhere for 3–4 h. The cells were stimulated with lipopolysaccharide (LPS, 1 µg/mL) for 1 h and subsequently treated with the hydroalcoholic flower extract at non-cytotoxic concentrations (5–100 µg/mL) dissolved in DMSO. After incubation for 20 h, equal volumes of culture supernatant and Griess reagent (1% sulfanilamide and 0.1% N-(1-naphthyl) ethylenediamine dihydrochloride in 2.5% phosphoric acid) were mixed, and absorbance was measured at 540 nm using a microplate reader. Nitric oxide inhibition was calculated using the following equation:

$$\% \text{ NO inhibition} = [(\text{Control NO} - \text{Treated NO}) / \text{Control NO}] \times 100$$

***In vitro* Antidiabetic Activity**

The glucose utilization assay was performed using $HepG_2$ human hepatocellular carcinoma cells. Cells were maintained in DMEM containing 4.5 g/L D-glucose supplemented with 10% heat-inactivated fetal bovine serum at 37°C in a humidified 5% $CO_2$ incubator. Approximately $5 \times 10^3$ cells/well were seeded into 96-well plates and cultured for 3 days.

The cells were treated with the hydroalcoholic flower extract at concentrations of 5, 10, 25, 50 and 100 µg/mL for 48 h. The culture medium was then replaced with incubation buffer (DMEM diluted with PBS containing 0.1% BSA and 8 mM glucose) and incubated for an additional 3 h. Metformin (0.1 µg/mL) was used as the positive control, while untreated cells served as the negative control. Subsequently, 10 µL of incubation medium was transferred to a fresh 96-well plate containing 200 µL glucose oxidase reagent, incubated for 15 min at 37°C, and absorbance was measured at 492 nm using a microplate reader. Glucose utilization was calculated relative to untreated control cells.

**Statistical Analysis**

All experiments were performed in triplicate, and results were expressed as mean ± standard deviation (SD). Statistical analysis was carried out using one-way analysis of variance (ANOVA) followed by an appropriate post hoc test. A value of $p < 0.05$ was considered statistically significant.

## RESULTS AND DISCUSSION

Hydroalcoholic extraction of 500 g of shade dried *Sphagneticola trilobata* flowers using 70% ethanol yielded 41.21 g of semisolid extract, corresponding to a percentage yield of 8.24%.

Qualitative phytochemical analysis of the hydroalcoholic flower extract revealed the presence of several bioactive constituents. Flavonoids and reducing sugars were present in relatively higher amounts, while glycosides, tannins, triterpenes, steroids, and carbohydrates were detected. Alkaloids and starch were absent.

***In vitro* Anti-inflammatory Activity**

The anti-inflammatory activity of the hydroalcoholic flower extract was evaluated by measuring inhibition of nitric oxide (NO) production in LPS-stimulated RAW 264.7 macrophages. The extract exhibited a concentration-dependent inhibition of nitric oxide production, with inhibition increasing from 10.25% at 10 µg/mL to 69.90% at 100 µg/mL (Table 1). The calculated $IC_{50}$ value was 67.23 ± 1.90 µg/mL, indicating appreciable anti-inflammatory activity.

**Table 1*: In vitro* anti-inflammatory activity of *Sphagneticola trilobata* flower extract**

| S.No | Concentration (µg/mL) | NO inhibition (%) |
|---|---|---|
| 1 | 10 | 10.25 |
| 2 | 25 | 25.17 |
| 3 | 50 | 37.34 |
| 4 | 75 | 57.45 |
| 5 | 100 | 69.9 |

***In vitro* Antidiabetic Activity**

The glucose utilization assay using HepG2 cells demonstrated that the hydroalcoholic flower extract significantly enhanced cellular glucose uptake in a concentration-dependent manner. At 100 µg/mL, the extract increased glucose utilization to 166.19 ± 3.86% of the untreated control, whereas metformin (0.1 µg/mL) produced 178.32 ± 4.62% glucose utilization (Table 2). Although the extract exhibited slightly lower activity than metformin, the results indicate substantial antidiabetic potential.

**Table 2: Effect of *Sphagneticola trilobata* flower extract on glucose utilization in HepG2 cells**

| S. No | Treatment | Glucose utilization (% of control) |
|---|---|---|
| 1 | Control | 100.00 ± 1.13 |
| 2 | Metformin (0.1 µg/mL) | 178.32 ± 4.62 |
| 3 | Extract (5 µg/mL) | 106.18 ± 1.16 |
| 4 | Extract (10 µg/mL) | 113.57 ± 2.12 |
| 5 | Extract (25 µg/mL) | 128.31 ± 2.63 |
| 6 | Extract (50 µg/mL) | 142.37 ± 2.74 |
| 7 | Extract (100 µg/mL) | 166.19 ± 3.86 |

## DISCUSSION

The present study demonstrated that the hydroalcoholic flower extract of *Sphagneticola trilobata* possesses significant *in vitro* antidiabetic and anti-inflammatory activities, which may be attributed to the presence of diverse bioactive phytochemicals. Preliminary phytochemical screening revealed

the presence of flavonoids, glycosides, tannins, triterpenes, steroids, carbohydrates, and reducing sugars, whereas alkaloids and starch were absent. Similar phytochemical constituents have previously been reported in *S. trilobata* and are considered responsible for its broad spectrum of pharmacological activities.[14,15].

Flavonoids were found to be the predominant phytoconstituents in the present study. These compounds are well known for their antioxidant, anti-inflammatory, and antihyperglycemic properties. Flavonoids improve glucose homeostasis by enhancing insulin sensitivity, promoting GLUT4-mediated glucose uptake, suppressing hepatic gluconeogenesis, and protecting pancreatic β-cells against oxidative stress. In addition, they inhibit inflammatory signaling pathways, including NF-κB activation, thereby reducing the production of pro-inflammatory mediators.[16,17]

The hydroalcoholic flower extract exhibited concentration-dependent inhibition of nitric oxide (NO) production in LPS-stimulated RAW 264.7 macrophages, with a maximum inhibition of 69.90% at 100 µg/mL and an $IC_{50}$ value of 67.23 ± 1.90 µg/mL. Nitric oxide is an important inflammatory mediator synthesized by inducible nitric oxide synthase (iNOS) in activated macrophages. Excessive NO production contributes to tissue injury and chronic inflammatory diseases. Therefore, inhibition of NO production indicates significant anti-inflammatory potential of the extract.[18,19]

The glucose utilization assay using HepG2 cells demonstrated a concentration-dependent increase in glucose uptake. At 100 µg/mL, the extract increased glucose utilization to 166.19 ± 3.86%, approaching the activity of the standard drug metformin (178.32 ± 4.62%). This enhancement may result from improved insulin sensitivity, activation of glucose transport pathways, and increased cellular glucose metabolism mediated by flavonoids and phenolic compounds.[20,21]

The findings of the present investigation are consistent with previous reports demonstrating anti-inflammatory, antioxidant, antimicrobial, hepatoprotective, and antidiabetic activities of *Sphagneticola trilobata*. Meena et al. reported significant anti-inflammatory activity of the leaf extract in experimental animal models, while Kanikaram et al. demonstrated antidiabetic and antioxidant activities of crude extracts of the whole plant. However, studies specifically evaluating the hydroalcoholic flower extract remain limited. Therefore, the present study provides additional scientific evidence supporting the pharmacological potential of the flowers as a valuable source of natural bioactive compounds.[22-25]

Overall, the observed antidiabetic and anti-inflammatory activities may result from the synergistic action of multiple phytochemicals, particularly flavonoids, phenolic compounds, tannins, and triterpenoids. These findings support the traditional medicinal use of *Sphagneticola trilobata* and

suggest that its flower extract could serve as a promising candidate for the development of plant-based therapeutics against diabetes and inflammatory disorders.

## CONCLUSION

The hydroalcoholic flower extract of *Sphagneticola trilobata* exhibited appreciable in vitro antidiabetic and anti-inflammatory activities**,** supported by the presence of biologically active phytochemicals, particularly flavonoids, glycosides, tannins, triterpenes, and steroids. The extract significantly inhibited nitric oxide production and enhanced glucose utilization in HepG2 cells in a concentration-dependent manner. These findings scientifically support the traditional medicinal use of *Sphagneticola trilobata* and suggest that its flowers may serve as a promising source of natural therapeutic agents for the management of diabetes and inflammatory disorders. Nevertheless, further phytochemical isolation, mechanistic investigations, in vivo pharmacological studies, and clinical evaluations are necessary to establish its efficacy and safety.

## REFERENCES

1. American Diabetes Association Professional Practice Committee. Standards of Care in Diabetes—2025. *Diabetes Care*. 2025;48(Suppl 1)–S350.
2. International Diabetes Federation. *IDF Diabetes Atlas*. 11th ed. Brussels: International Diabetes Federation; 2025.
3. Donath MY, Shoelson SE. Type 2 diabetes as an inflammatory disease. *Nat Rev Immunol*. 2011;11(2):98–107.
4. Hotamisligil GS. Inflammation, metaflammation and immunometabolic disorders. *Nature*. 2017;542:177–185.
5. Salehi B, Ata A, Anil Kumar NV, et al. Antidiabetic potential of medicinal plants and their active components. *Biomed Pharmacother*. 2019;120:109421.
6. Etxeberria U, de la Garza AL, Campión J, Martínez JA, Milagro FI. Antidiabetic effects of natural plant extracts via AMPK activation. *Mini Rev Med Chem*. 2012;12(7):698–706.
7. Bohlmann F, Zdero C. Terpenoids and flavonoids from *Wedelia* species. *Phytochemistry*. 1982;21:2543–2549.
8. Lim TK. *Edible Medicinal and Non-Medicinal Plants*. Vol. 7. Dordrecht: Springer; 2013.
9. Meena AK, Rao MM, Panda P, Renu. Evaluation of anti-inflammatory activity of *Wedelia trilobata* in experimental models. *Pharmacognosy Research*. 2011;3(3):174–177.

10. Mandal SC, et al. Antibacterial activity of *Wedelia trilobata* extracts. *Indian Journal of Pharmaceutical Sciences*. 2005;67:148–150.
11. Karmegam N, et al. Hepatoprotective activity of ethanolic extract of *Wedelia trilobata* against $CCl_4$-induced hepatotoxicity in rats. *Journal of Ethnopharmacology*. 2008;116:204–210.
12. Sureshkumar SV, Mishra SH. Evaluation of analgesic activity of *Wedelia trilobata*. *Indian Drugs*. 2007;44:475–478.
13. Kanikaram S, et al. Quantitative estimation of phytochemicals, antidiabetic and antioxidant activities of crude extracts of *Sphagneticola trilobata* (L.) and *Adhatoda vasica* Linn. *International Journal of Pharmaceutical Sciences and Research*. 2018;9(8):3276–3283.
14. Lim TK. *Edible Medicinal and Non-Medicinal Plants*. Vol. 7. Dordrecht: Springer; 2013.
15. Bohlmann F, Zdero C. Terpenoids and flavonoids from *Wedelia* species. *Phytochemistry*. 1982;21:2543–2549.
16. Salehi B, Ata A, Anil Kumar NV, et al. Antidiabetic potential of medicinal plants and their active constituents. *Biomed Pharmacother*. 2019;120:109421.
17. Hotamisligil GS. Inflammation, metaflammation and immunometabolic disorders. *Nature*. 2017;542:177–185.
18. Green LC, Wagner DA, Glogowski J, Skipper PL, Wishnok JS, Tannenbaum SR. Analysis of nitrate, nitrite and [15N] nitrate in biological fluids. *Anal Biochem*. 1982;126:131–138.
19. Donath MY, Shoelson SE. Type 2 diabetes as an inflammatory disease. *Nat Rev Immunol*. 2011;11(2):98–107.
20. Etxeberria U, de la Garza AL, Campión J, Martínez JA, Milagro FI. Antidiabetic effects of natural plant extracts via AMPK activation. *Mini Rev Med Chem*. 2012;12(7):698–706.
21. American Diabetes Association Professional Practice Committee. Standards of Care in Diabetes—2025. *Diabetes Care*. 2025;48(Suppl 1)–S350.
22. Meena AK, Rao MM, Panda P, et al. Evaluation of anti-inflammatory activity of *Wedelia trilobata* in experimental models. *Pharmacognosy Research*. 2011;3(3):174–177.
23. Kanikaram S, et al. Quantitative estimation of phytochemicals, antidiabetic and antioxidant activities of crude extracts of *Sphagneticola trilobata* (L.) and *Adhatoda vasica* Linn. *Int J Pharm Sci Res*. 2018;9(8):3276–3283.
24. Karmegam N, et al. Hepatoprotective activity of *Wedelia trilobata* against carbon tetrachloride-induced hepatotoxicity. *J Ethnopharmacol*. 2008;116:204–210.

25. Mandal SC, et al. Antimicrobial activity of *Wedelia trilobata* extracts. *Indian J Pharm Sci*. 2005;67:148–150.