

A Review: Phytochemical and Pharmacological Investigation on *Mollugo nudicaulis* Lam for Anti- Diabetic Activity

Gurwinder Pal Singh^{1*}, Dr. Sushil Bhargav²

1 Research Scholar, Department of Pharmacy, Madhav University, Pindwara Sirohi
Rajasthan, India

singh.gurwinderpal545@gmail.com.

2 Dean Deptt of Pharmacy, Madhav University, Pindwara Sirohi Rajasthan, India

Abstract: The hallmark of diabetes mellitus, a chronic metabolic disease, is persistent hyperglycemia brought on by deficiencies in either insulin action or secretion, or both. The quest for alternative therapeutic agents, such as medicinal plants with hypoglycemic potential, has become necessary due to the rising prevalence of diabetes worldwide. A lesser-known medicinal plant called *Mollugo nudicaulis* Lam has long been utilised for a number of therapeutic purposes, such as hepatoprotective and anti-inflammatory actions. *Mollugo nudicaulis* Lam's phytochemical composition, pharmacological potential, and anti-diabetic effectiveness are highlighted in this review, along with its mode of action, clinical significance, and promise for further study.

Keywords: *Mollugo nudicaulis*, phytochemicals, anti-diabetic activity, insulin resistance, herbal medicine

INTRODUCTION

Millions of people worldwide suffer from diabetes mellitus (DM), a chronic metabolic disease that has a major influence on public health. It is mostly characterized by persistently elevated blood sugar levels brought on by the body's inefficient production or use of insulin. Type 1 diabetes (T1D), an autoimmune disease that destroys beta cells in the pancreas, and Type 2 diabetes (T2D), which is mostly caused by insulin resistance and decreased insulin output, are the two primary forms of the ailment. Another kind of diabetes that develops during pregnancy but raises the chance of getting type 2 diabetes later in life is called gestational diabetes¹⁻³.

A number of variables, including poor eating habits, genetic susceptibility, and sedentary lifestyles, have contributed to the sharp rise in the incidence of diabetes over the past several decades. Diabetes can cause serious side effects such retinopathy, nephropathy, neuropathy,

and cardiovascular disease if it is not controlled. Insulin therapy, oral hypoglycemic medications like metformin and sulfonylureas, and lifestyle changes including exercise and nutrition are the traditional methods of treating diabetes. However, these therapies frequently have drawbacks, including side effects, exorbitant expenses, and patient non-compliance⁴⁻⁵.

These drawbacks have raised interest in investigating natural options for the treatment of diabetes. The potential of medicinal herbs to improve insulin sensitivity and reduce blood glucose levels has been extensively researched. Because of its anti-inflammatory, hepatoprotective, and antioxidant qualities, *Mollugo nudicaulis* Lam, a medicinal plant of the Molluginaceae family, has long been employed in a variety of herbal treatments. According to recent studies, its complex phytochemical composition—which contains flavonoids, alkaloids, saponins, and tannins—may also have important anti-diabetic effects⁵⁻⁶.

The purpose of this review is to investigate *Mollugo nudicaulis* Lam's phytochemical and pharmacological characteristics in relation to its possible anti-diabetic effects. This study aims to shed light on *Mollugo nudicaulis's* potential as a complementary or alternative treatment for diabetes mellitus by analyzing its mode of action, clinical data, and future research directions⁶⁻⁷.

ETIOLOGY

The development of diabetes mellitus is influenced by genetic and environmental factors. Major risk factors include obesity, sedentary lifestyle, high-calorie diet, oxidative stress, and genetic predisposition. *Mollugo nudicaulis* Lam has been reported to contain antioxidants and bioactive compounds that may counteract oxidative stress-related pancreatic beta-cell damage⁹⁻¹⁰.

PATHOPHYSIOLOGY

The main cause of diabetes mellitus is impaired glucose metabolism. Autoantibodies target beta cells in the pancreas in type 1 diabetes, resulting in complete insulin insufficiency. Insulin resistance and compensatory hyperinsulinemia are hallmarks of type 2 diabetes, which ultimately leads to beta-cell failure and hyperglycemia. *Mollugo nudicaulis* contains phytochemicals that may enhance pancreatic function and insulin sensitivity¹¹⁻¹³.

DIAGNOSIS

Numerous biochemical tests are used to detect diabetes, including:

≥ 126 mg/dL for fasting plasma glucose (FPG)

After two hours, the oral glucose tolerance test (OGTT) is ≥ 200 mg/dL.

HbA1c (hemoglobin A1c): $\geq 6.5\%$

Symptomatic random plasma glucose level: ≥ 200 mg/dl¹³⁻¹⁴

TREATMENT

Currently available treatment options include of:

Oral hypoglycemic agents include SGLT2 inhibitors, DPP-4 inhibitors, sulfonylureas, and metformin.

Insulin therapy is used to treat advanced type 2 diabetes and type 1 diabetes.

Lifestyle changes include food, exercise, and weight control.

Herbal Remedies: The potential anti-diabetic effects of traditional botanicals like *Mollugo nudicaulis* are being studied¹⁵⁻¹⁸.

PHYTOCHEMICAL COMPOSITION OF *MOLLUGO NUDICAULIS*

Studies have identified several bioactive constituents in *Mollugo nudicaulis*, including:

- **Flavonoids:** Quercetin, kaempferol (antioxidant, anti-diabetic properties)
- **Alkaloids:** Known to influence glucose metabolism
- **Saponins:** Regulate lipid metabolism and glucose uptake
- **Tannins & Phenols:** Exhibit free radical scavenging activity¹⁹

MECHANISM OF ANTI-DIABETIC ACTION

Potential anti-diabetic mechanisms of *Mollugo nudicaulis* include:

- **Enhancing Insulin Secretion:** Stimulates pancreatic beta cells.
- **Improving Insulin Sensitivity:** Increases glucose uptake in peripheral tissues.
- **Reducing Oxidative Stress:** Protects beta cells from oxidative damage.

- **Inhibiting Alpha-glucosidase:** Slows carbohydrate digestion and absorption²⁰

CLINICAL EVIDENCES

Numerous in vivo and preclinical investigations indicate that *Mollugo nudicaulis* has strong anti-diabetic properties. Oral administration of *Mollugo nudicaulis* extract significantly lowers fasting blood glucose levels, according to studies done on diabetic animal models. According to a research, diabetic rats given extract from *Mollugo nudicaulis* for four weeks saw a 35% drop in blood glucose levels. Improvements in insulin sensitivity and pancreatic beta-cell activity were noted in another investigation, which may have implications for the treatment of diabetes.

There are currently few human clinical studies, despite encouraging preclinical findings. To verify the effectiveness and safety of *Mollugo nudicaulis* in the treatment of diabetes in human populations, well-designed, randomised controlled studies are required. Future studies should focus on determining optimal dosages, bioavailability, and long-term effects²²⁻²³.

FUTURE SCOPE OF STUDY

Human Clinical Trials: Performing extensive human research to confirm the anti-diabetic outcomes of preclinical investigations.

Mechanistic Studies: Examining the molecular mechanisms by which *Mollugo nudicaulis* prevents diabetes, including its function in glucose metabolism and insulin signalling.

Formulation Development: To guarantee constant therapeutic efficacy, standardised dosage forms, such as tablets, capsules, or herbal extracts, are developed.

Combination therapy: Assessing how *Mollugo nudicaulis* may work in concert with current anti-diabetic medications such as insulin or metformin to improve treatment results.

Toxicity and Safety Studies: Determining the safety profile and possible adverse effects of long-term usage of *Mollugo nudicaulis* to guarantee diabetic people may safely consume it²⁴⁻²⁵.

CONCLUSION

It is diverse pharmacological effects and rich phytochemical makeup, *Mollugo nudicaulis* Lam has great promise as an anti-diabetic drug. Its effectiveness in lowering blood glucose levels and enhancing insulin sensitivity is supported by preclinical research. To prove its safety and therapeutic potential, more investigation is necessary, including human clinical studies. Its function in the treatment of diabetes will become clearer as the molecular mechanisms of action are examined. It will be more applicable in contemporary medicine if standardized formulations are created and its long-term safety is assessed. Additionally, using *Mollugo nudicaulis* with traditional anti-diabetic medications may enhance the effectiveness of treatment. To optimize its effects, future research should concentrate on improving dose, bioavailability, and delivery techniques. All things considered, *Mollugo nudicaulis* Lam shows potential as a natural treatment for diabetes and merits more investigation in clinical and pharmacological studies.

References

1. American Diabetes Association. (2021). Standards of medical care in diabetes—2021. *Diabetes Care*, 44(1), S1-S232.
2. DeFronzo, R. A., Ferrannini, E., Groop, L., Henry, R. R., Herman, W. H., Holst, J. J., & Weiss, R. (2015). Type 2 diabetes mellitus. *Nature Reviews Disease Primers*, 1(1), 1-22.
3. Gupta, R., Sharma, A., & Verma, S. (2020). Anti-diabetic effects of *Mollugo nudicaulis* extract in experimental diabetic models. *Journal of Ethnopharmacology*, 250, 112488.
4. Kumar, S., Mishra, A., & Pandey, A. K. (2021). Antidiabetic potential of medicinal plants. *Biomedicine & Pharmacotherapy*, 137, 111334.
5. Patel, D. K., Kumar, R., & Laloo, D. (2022). Herbal medicines for diabetes management. *Phytomedicine*, 91, 153688.
6. Powers, A. C., & D'Alessio, D. (2019). Endocrine pancreas and pharmacotherapy of diabetes mellitus and hypoglycemia. In Brunton, L., & Knollmann, B. (Eds.), *Goodman & Gilman's: The Pharmacological Basis of Therapeutics* (13th ed., pp. 1477-1514). McGraw Hill.

7. Rao, M. V., Anandan, S., & Chidambaram, R. (2018). Phytochemical screening of *Mollugo nudicaulis*. *Journal of Medicinal Plants Research*, 12(19), 267-273.
8. Sharma, V., Singh, R., & Gupta, P. (2019). Pharmacological evaluation of *Mollugo nudicaulis* for its potential anti-diabetic properties. *BMC Complementary Medicine and Therapies*, 19(1), 133.
9. Singh, R., Kumar, A., & Agarwal, V. (2020). A review on phytochemical and pharmacological properties of *Mollugo nudicaulis*. *Journal of Herbal Medicine*, 24, 100384.
10. World Health Organization. (2021). *Global report on diabetes*. WHO Press.
11. Ahmad, S., & Beg, Z. H. (2021). Phytochemicals in diabetes therapy: Mechanisms and challenges. *Critical Reviews in Food Science and Nutrition*, 61(15), 2487-2503.
12. Choudhury, H., Pandey, M., & Sahu, R. (2020). Role of flavonoids in diabetes treatment. *Phytotherapy Research*, 34(1), 472-483.
13. Das, M., & Barman, S. (2019). Antioxidant and antidiabetic potential of traditional medicinal plants. *Indian Journal of Pharmacology*, 51(3), 132-141.
14. Khan, M. S., & Javed, S. (2020). Natural products for diabetes treatment: Clinical evidence and mechanisms. *Journal of Ethnopharmacology*, 250, 112487.
15. Mishra, B. K., & Tripathi, S. (2021). Role of alkaloids in glucose metabolism regulation. *Fitoterapia*, 145, 104673.
16. Mohan, V., & Unnikrishnan, R. (2022). Epidemiology of diabetes in India: Current scenario and future perspectives. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 16(1), 102345.
17. Mukherjee, P. K., & Houghton, P. J. (2019). Phytochemical screening and pharmacological properties of herbal medicines. *Phytomedicine*, 70, 153193.
18. Pandey, S., & Tripathi, Y. B. (2020). Herbal medicines in the treatment of diabetes. *Journal of Ayurveda and Integrative Medicine*, 11(3), 339-347.
19. Sharma, A., & Verma, R. (2021). Mechanistic insights into the role of saponins in diabetes management. *Pharmacognosy Reviews*, 15(1), 21-34.

20. Srivastava, A. K., & Pandey, R. (2019). The role of tannins in glucose metabolism. *Food & Function*, 10(7), 3357-3372.
21. Tiwari, A. K., & Madhusudana, R. (2020). Role of traditional medicinal plants in diabetes therapy. *Journal of Diabetes Research*, 2020, 4653219.
22. Verma, N., & Kumar, V. (2022). Recent advancements in diabetes therapy using plant-derived compounds. *Phytotherapy Research*, 36(5), 2341-2360.
23. Wang, C., & Li, X. (2021). Therapeutic potential of natural antioxidants in diabetes management. *Molecules*, 26(6), 1832.
24. Xu, L., & Chen, W. (2020). Effects of polyphenols in diabetes therapy. *Journal of Functional Foods*, 67, 103847.
25. Zhao, M., & Zhang, H. (2019). Bioactive compounds from medicinal plants and their effects on diabetes. *Current Pharmaceutical Design*, 25(21), 2358-2371.