

The Efficacy of *Aspidium Cicutarium* in The Management of Diabetes

SAKSHI MOGHE¹, DR. VISHAL SHRIVASTAVA², PRADEEP K. YADAV³, DR. AKHLESH K. SINGHAI⁴

^{1, 2, 3, 4} School of Pharmacy, LNCTU, Kolar Road, Bhopal

Abstract— *Aspidium cicutarium* (Kuklutnakhi), a medicinal plant used in traditional medicine, has been explored for its various health benefits. Despite its well-established anti-inflammatory effects, the antidiabetic potential of *Aspidium cicutarium* remains largely unexplored. This study aimed to evaluate the feasibility of *Aspidium cicutarium* as a potential natural remedy for diabetes management. Additional investigations are warranted to elucidate the effects of *Aspidium cicutarium* on blood sugar regulation and associated mechanisms. Future studies should include *in vitro* and *in vivo* assays to determine the effects of the plant extract on glucose uptake, insulin sensitivity, and pancreatic function. Additionally, phytochemical analysis could identify bioactive compounds that might contribute to any observed antidiabetic effects. By investigating *Aspidium cicutarium*'s potential role in diabetes management, we can contribute to the exploration of natural remedies for blood sugar control. However, rigorous scientific evaluation is crucial before considering it as a therapeutic option.

Index Terms— *Aspidium Cicutarium*, Kuklutnakhi, Dryopteridaceae, Antidiabetic, Pharmacological Activity, Traditional Medicine

I. INTRODUCTION

The medicinal herb *Aspidium cicutarium* (Kuklutnakhi) has shown promise in various therapeutic applications. This herb's rhizomes are thought to be effective in managing inflammation. This is attributed to their reported antioxidant, anti-inflammatory, cytotoxic, and free radical scavenging properties. This fauna belongs to the Dryopteridaceae family which is distributed in elevated ranges of 5000ft in tropical regions worldwide. In India, it is commonly found in the Sahyadri mountain ranges in the Konkan region of Maharashtra.

Aspidium cicutarium L

Aspidium cicutarium L. is a plant species with various synonyms such as *Tectaria coandunata*, *Nephrodium*

cicutarium, and *Aspidium coandunata*. It belongs to the Dryopteridaceae family and has been studied for its pharmacological activities. The plant's rhizomes are short creeping and densely scaly, with macroscopic and microscopic characteristics that include tannin content, starch grains, and a dictyostele vascular arrangement. The plant has been found to exhibit free radical scavenging, anti-oxidant, cytotoxic, and anti-inflammatory activities.

Pharmacological Activities

Aspidium cicutarium has been shown to possess potent antioxidant, free radical scavenging, cytotoxic, and anti-inflammatory properties. Notably, its methanolic rhizome extract exhibits concentration-dependent free radical scavenging activity, rivaling that of standard control substances. Additionally, the ethanolic extract of *Aspidium cicutarium* has shown anti-inflammatory activity in animal models, indicating its potential therapeutic benefits.

Experimental Work

The experimental work involved the selection and collection of plant material, extraction procedures, determination of percentage yield, qualitative evaluation of phytochemical constituents, and quantitative studies of bioactive constituents. Standard methods were employed to quantify the total alkaloid and phenol content in the *Aspidium cicutarium* extract, confirming the presence of these compounds. In conclusion, the research paper explores the efficacy of *Aspidium cicutarium* in the management of diabetes, highlighting its pharmacological activities and bioactive constituents. The findings suggest that *Aspidium cicutarium* may hold potential as a natural remedy for diabetes management, warranting further investigation into its therapeutic properties.

II. OVERVIEW OF *ASPIDIUM CICUTARIUM*

Kuklutnakh, also known as *Aspidium cicutarium*, is a medicinal plant traditionally used and classified under the Dryopteridaceae family. It is traditionally used in the treatment of inflammation, with its rhizomes reported to be effective in managing various health conditions. The *Aspidium cicutarium* plant possesses antioxidant, anti-inflammatory, cytotoxic, and free radical scavenging properties. Research reveals that the methanolic and aqueous extracts of *Aspidium cicutarium* contain biologically active compounds such as sugars, carbohydrates, tannins, steroids, flavonoids, and saponins, which contribute to its medicinal benefits.

III. TAXONOMIC CLASSIFICATION AND DESCRIPTION

3.1 Macroscopic Description

The rhizomes of *Aspidium cicutarium* are short creeping structures, up to 3 cm thick, and densely scaly at the apex. The scales are ovate-lanceolate, pale to dark brown, with an acuminate apex and sparsely ciliated margins. The stipes are scattered, approximately 0.5 cm apart, with a rounded abaxial surface and a grooved adaxial surface. They are castaneous or greyish-brown, glabrous, and glossy all over.

3.2 Microscopic Description

The epidermal layer of *Aspidium cicutarium's* rhizome, as seen in a transverse section, is composed of a single layer of barrel-shaped cells. The outermost surface of these cells contains tannins. The cortex exhibits a distinct two-layered structure: The outer cortex features thick, lignified cell walls. The inner cortex comprises parenchyma cells, which store prismatic crystals of calcium oxalate, oil globules, and starch grains. The ground tissue comprises parenchyma cells and a central vascular cylinder organized in a dictyostele pattern. The pith, composed of non-specialized parenchyma cells, occupies the interior of the meristellar ring, which harbors discrete meristematic regions arranged elliptically or circularly.

This detailed taxonomic classification and description provide insights into the structural characteristics of

Aspidium cicutarium, which are essential for understanding its medicinal properties and potential therapeutic applications in the management of various health conditions.

IV. ORIGIN AND DISTRIBUTION OF *ASPIDIUM CICUTARIUM*

Aspidium cicutarium, also known as Kuklutnakh, is a medicinal plant species that belongs to the Dryopteridaceae family. In tropical zones globally, this fern flourishes at heights of approximately 5000 feet in elevated terrains. *Aspidium cicutarium*, while found across India, thrives particularly in the Sahyadri mountain ranges of Maharashtra's Konkan region. Its abundance is especially notable in areas like Arbalighat, Mahabaleshwar, Panchgani, Khandala, Matheran, and Dajipur above Fondaghat. The plant's geographical distribution makes it easily accessible for medicinal and research purposes.

V. PHARMACOLOGICAL ACTIVITIES OF *ASPIDIUM CICUTARIUM*

5.1 Free Radical Scavenging Activity

Aspidium cicutarium rhizome extract in methanol exhibits free radical scavenging ability in a dose-dependent manner. This activity is commensurate with that observed in positive controls, such as pyrogallol and ascorbic acid, across different models. The extract exhibited good free radical scavenging activity, indicating its potential antioxidant properties.

5.2 Anti-oxidant Activity

The ethanolic extract of *Aspidium cicutarium* demonstrated significant antioxidant activity compared to the aqueous extract. The ethanolic extract demonstrated antioxidant properties, a characteristic attributed to the presence of phenolic compounds. Phenolic compounds are powerful antioxidants known for their chain-breaking abilities, which help in combating oxidative stress.

5.3 Cytotoxic Activity

The ethanolic extract of *Aspidium cicutarium* exhibited significant cytotoxic activity. Kuklutnakh root, rich in polyphenolic compounds, possesses anti-mutagenic and anti-carcinogenic properties in human cells. Cytotoxicity analysis of the extract was

performed using the MTT assay against human cervical and breast cancer cell lines.

5.4 Anti-inflammatory Activity

Ethanollic extracts of *Aspidium cicutarium* significantly reduced hind paw swelling in rats induced by carrageenan injection. The anti-inflammatory effects of the extract might stem from the presence of steroids or terpenoids, substances with established anti-inflammatory properties.

VI. EXPERIMENTAL WORK

6.1 Selection of Plant Material

The selection of *Aspidium cicutarium* roots as the plant material for the study was based on its wide geographical distribution and economic importance. The availability of the plant material and its medicinal properties make it a suitable candidate for pharmacological research.

6.2 Collection of Plant Material

Aspidium cicutarium roots, collected from the Bhopal region, were shade-dried to preserve their bioactive compounds. The dried roots were then powdered for further extraction and analysis.

6.3 Extraction Procedure

The extraction of *Aspidium cicutarium* roots was carried out using a hydroalcoholic solvent through the maceration process. The extract was evaporated to obtain the dried extract for further analysis of bioactive constituents.

6.4 Determination of Percentage Yield

The extraction process resulted in a 6.25% weight-to-weight yield, calculated from the dried roots. This yield measurement provides information on the efficiency of the extraction process.

6.5 Qualitative Evaluation

The extract underwent a series of phytochemical analyses to identify the presence of bioactive compounds, including alkaloids, carbohydrates, glycosides, saponins, phenols, flavonoids, proteins, and diterpenes. The results of these tests provide insights into the chemical composition of the extract.

6.6 Quantitative Studies of Bioactive Constituents

6.6.1 Estimation of Total Alkaloid Content

The total alkaloid content in the extract was determined to be 0.752 mg per 100 mg of the sample. Alkaloids play a significant role in the medicinal properties of *Aspidium cicutarium* and contribute to its pharmacological activities.

6.6.2 Estimation of Total Phenol Content

The sample contained 0.526 mg of total phenols per 100 mg. Phenols are known for their antioxidant properties and may contribute to the extract's ability to scavenge free radicals and protect against oxidative damage.

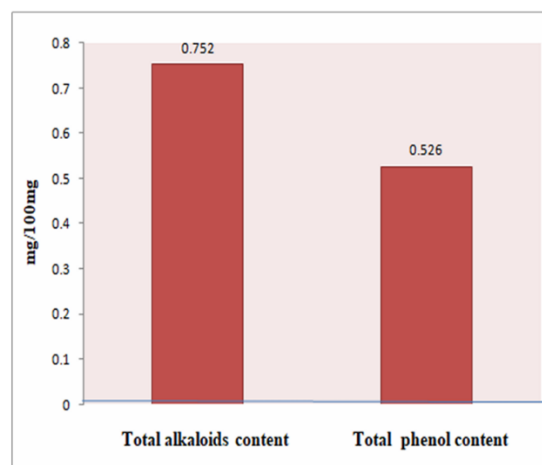


Fig: Total alkaloid and Total phenolic content of *Aspidium cicutarium*

VII. RESULTS AND DISCUSSION

Phytochemical analysis of the extract confirmed the presence of alkaloids, phenols, proteins, and diterpenes. However, carbohydrates, glycosides, saponins, and flavonoids were absent. The research on *Aspidium cicutarium* has yielded valuable insights into its potential pharmacological properties and bioactive constituents.

The quantitative analysis showed that the extract contained a total alkaloid content of 0.752 mg per 100 mg and a total phenol content of 0.526 mg per 100 mg. These results further support the medicinal potential of *Aspidium cicutarium* and its bioactive constituents.

The hypoglycemic effects of *Aspidium cicutarium* roots extract were evaluated in diabetic rats, comparing two doses (100 mg/kg and 200 mg/kg) to the standard antidiabetic drug glibenclamide (600 µg/kg). A total of 30 rats were divided into five groups, including normal and diabetic controls, to evaluate the effectiveness of the treatments.

The results demonstrated a significant impact of diabetes on body weight, with the diabetic-control group experiencing substantial weight loss, dropping from 178.30±7.20 g to 138.00±6.15 g. This weight loss highlights the severe metabolic disturbances caused by untreated diabetes, which can lead to decreased body mass, impaired glucose utilization, and muscle wasting.

In contrast, the group treated with a low dose of *Aspidium cicutarium* roots extract (100 mg/kg) exhibited a mitigated reduction in body weight, decreasing from 179.65±4.30 g to 150.30±5.30 g. This outcome suggests that even at a lower dose, the extract provides some protective effects against diabetes-induced weight loss, potentially through its hypoglycemic and health-restorative properties.

Notably, the group receiving a higher dose of *Aspidium cicutarium* roots extract (200 mg/kg) experienced a significant preservation of body weight, reducing from 182.00±4.80 g to 169.43±5.41 g. This more substantial retention of body mass indicates a dose-dependent response, where the higher concentration of the extract offers enhanced protective effects against the metabolic disturbances caused by diabetes.

The diabetic group treated with glibenclamide (600 µg/kg), a standard antidiabetic medication, also showed a significant reduction in weight loss, with body weight decreasing from 189.30±4.70 g to 154.62±4.91 g, aligning with the known efficacy of glibenclamide in managing diabetes and mitigating its adverse effects on body weight and metabolism.

Grouping of Animal	Dose	No. of Animal
Group I	Normal-control (0.5 ml distilled water/day/rat)	6
Group II	Diabetic-control	6
Group III	Diabetic + <i>Aspidium cicutarium</i> roots extract (100 mg/kg p.o.)	6
Group IV	Diabetic + <i>Aspidium cicutarium</i> roots extract (200mg/kg p.o.)	6
Group V	Diabetic + Glibenclamide (600µg/kg p.o.)	6

Table: Grouping of animals for experimental procedures

Group	Treatment	Initial Body weight (g)	Final Body weight (g)
I	Normal	180.50±6.10	187.35±5.90
II	Diabetic Control	178.30±7.20	138.00±6.15#
III	Diabetic + <i>Aspidium cicutarium</i> roots extract (100 mg/kg)	179.65±4.30	150.30±5.30*
IV	Diabetic + <i>Aspidium cicutarium</i> roots extract (200 mg/kg)	182.00±4.80	169.43±5.41**
V	Diabetic + Glibenclamide (600µg/kg)	189.30±4.70	154.62±4.91***

Table: Effect of *Aspidium cicutarium* roots extract treatment on body weight in rats

Group	Treatment	Initial Blood glucose (mg/dL)	Final Blood glucose (mg/dL)
I	Normal	95.00±1.10	97.00±1.28
II	Diabetic Control	256.00±5.10	414.55± 9.86 [#]
III	Diabetic + <i>Aspidium cicutarium</i> roots extract (100 mg/kg)	244.00±6.34	139.50 ± 5.92 [*]
IV	Diabetic + <i>Aspidium cicutarium</i> roots extract (200 mg/kg)	246.00±8.26	121.18 ± 5.52 ^{**}
V	Diabetic + Glibenclamide (600µg/kg)	244.00±7.89	115.81 ± 3.75 ^{***}

Values are expressed as mean±SD (n = 6). Values are statistically significant at [#]p<0.001 vs. normal group; *P < 0.001, **P < 0.05, ***P < 0.0001 vs. diabetic control group (Two-way ANOVA test).

Table: Effect of *Aspidium cicutarium* roots extract treatment on blood glucose in normal and diabetic rats

In conclusion, the study on *Aspidium cicutarium* roots has provided valuable information on its pharmacological activities, chemical composition, and potential therapeutic benefits. Further research and clinical studies are warranted to explore the full therapeutic potential of this medicinal plant in the management of various health conditions, including diabetes.

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