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A Comprehensive Review on Adiantum Incisum (Maidenhair)

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Abstract

A traditional medicinal maidenhair fern Adiantum incisum member of pteridaceae family widely distributed in hilly areas has been reported for its traditional uses as a medicinal fern. The presence of active nutrients and their multifunctional roles make Adiantum spp. leaves perfect candidates for the production of phyto-pharmaceutical products. It is used traditionally as remedy in different disease conditions like diabetes, inflammation, skin disease, liver disorder, fever etc. It is important to clarify these health benefits to public due to the increasing need for prevention and treatment of chronic diseases. Although it is used widely around the country, single hand information about its ethnobotanical, phytochemical and pharmacological action is still lacking. Traditionally appreciated for its pharmacological properties by the various researcher maidenhair is still hard to recognized because of insufficient information. The aim of this review is to summarize all the traditional property of Adiantum incisum.

Keywords: *Adiantum incisum*, Fern, Traditional, Phyto-pharmacological, Diabetes

INTRODUCTION

Today drugs from plants, animals, minerals have great role in development of new drug in spite lack of scientific progress and advance technology. Considering the toxic adverse effects of synthetic medicines [1], the global population is looking for natural remedies, which are safe, economic, effective and easily available. India is one of the greatest sources of diverse medicinal and aromatic plants, stored in an enormous amount of natural flora [2, 3].

Plant based medicine are in use to treat various disorders since ancient time. As the procurement of natural drugs was easy so the early man utilized plants for medication and for its therapeutic value [4]. Traditionally plants used to provide clothing, food, shade and medicine. Most of the therapeutic and medicinal use of plants and natural drugs developed by monitoring animal's activity and through trial and error methods [5, 6].

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Recent estimates recommend that, a large division of the population depends directly or indirectly on natural drugs to fulfill their primary healthcare requirements. Lots of person in developed country also have faith in indigenous, alternative or complementary system of treatment, including medicinal plants [7, 8].

A natural treatment is more community acceptable, diabetes treatments with herbal product may be easier to integrate into daily life than taking a pill or injections. Only drawback of use of

natural plants product is seasonal availability of fresh material on daily basis [9]. The safety and potency of various herbal plants has been probed by researcher globally, from Europe to the other part of world. Due to modern technology, scientist can now easily detect specific effect and interactions of chemical constituents. With this validated data, we can identify why certain plant are effective against certain disease.

A traditional medicinal maidenhair fern is evergreen fern widely distributed in mostly hilly areas, commonly called trailing maidenhair. There are countless varieties of maidenhair ferns and they therefore offer the perfect match for every need and taste of a plant lover. Originally native to tropical rain regions, it now feels comfortable in the balcony, boxes or pots and in flower bed, although not all varieties are winter proof. The maidenhair fern is very undemanding, but there still is a certain need for care in order for it to grow healthy and powerful for many years. This maidenhair fern also known as *Adiantum incisum* as its botanical name. It is known as Nilakantha-shikha, Mayurshikha, Vahrishikha in Ayurveda [10-13].

TAXONOMICAL CLASSIFICATION

Taxonomical classification of *A. incisum* are as follows [14]

- **Kingdom:** Plantae
- **Subkingdom:** Tracheobionta
- **Division:** Pteridophyte
- **Class:** Polypodiopsida
- **Order:** Polypodiale
- **Family:** Pteridaceae
- **Genus:** Adiantum
- **Species:** A. incisium

Synonyms

Adiantum caudatum forsk, Adiantum flagelliferum wall, Adiantum capillus- veneris.

Description

The size of the whole plant is approximately 30-70 cm or 12-28 inch. It is an erect or spreading fern with cylindrical rhizome. Rhizomes are short, erect, with tufted fronds and with brown subulate rhizome-scales size 4 mm long. Stripe castaneous to black, up to 9 cm long with numerous brown hairs. Roots and stem are dark brown color. The lower half of the stem is densely hairy, and sometimes wears narrow pale brown scales. Fronds linear in outline, 15—30 cm long, simply pinnate, often elongated (Figures 1 and 2).

Figure 1. Arial view of *Adiantum incisum.*

Figure 2. Close view of leaf *A. incisum.*

Leaflets 1.2—1.8 cm long, nearly sessile, upper margin rounded and more or less cut, often deeply and repeatedly, the apex usually blunt, the lower line straight and horizontal, the lower leaflets slightly stalked, coriaceous, veins prominent, the rachis and both surfaces of the frond villose. Sori marginal, roundish or transversely oblong on the edge of the lobes, indusium of the same shape as the sorus formed of the reflexed margin of the fronds bearing the capsules on its underside, veins free [15, 16].

Habitat: Moist shady places especially on damp old walls and crevices of rocks.

Origin: Rainy tropical regions.

Distribution: World wide the plant are found in Dhaka, Chuadanga, kushtia, Rajshahi in shade. Also found in Sri Lanka, Malay Peninsula, South China, tropical Africa, Java, Mauritius. Nationally it is found in the plains and the lower slopes of the hills in Punjab, Rajasthan, West Bengal, Tamil Nadu and Maharashtra.

Duration: Perennial.

Part(s) used for medicinal purpose: Whole plant.

Plant type / Growth Habit: Forbs/herb.

Propagation: Through rhizome and spore.

CHEMICAL CONSTITUENTS

The fern contains triterpenoids (including adiantone, isoadiantone) and flavonoids (including rutin and isoquercetin), hentriacontane, 16-hentriacontanone, adiantone, isoadiantone, β-sitosterol and fernene. It also contains phenylpropanoids, oleananes, alicyclic, and carotenoids [17].

Traditional Uses

Adiantum incisum is used in the treatment of chest affections, cough, diabetes, fever and skin diseases. The leaves are used in diabetes and as a cure for coughs and fevers. It gives relief in internal heat or fever due to cooling action (Table 1) [18-23].

Table 1. Disease and their traditional treatments.

Diabetes	The Whole and Juice of fronds are used to treat diabetes.
Hepato-protective	The powder of leaves utilize in liver diseases
Skin disease	Leaves are applied topically for skin disease.
Malaria	The leaves and Fronds paste is used to treat malaria.
Emetic	Large dose of this fern used as emetic.
Bronchial disease	The leaves are used as a cure for cough and bronchial affection.
Bone fracture	The roots powder is used in bone fracture.
Alopecia	Paste of fresh or dried leaves with coconut oil are used in hair fall.

Pharmacological effect of Plant *Adiantum incisum*

1. Anti Diabetic effect
2. Anti Inflammatory effect
3. Anti Bacterial effect
4. Anti Fertility effect

5. Anti Microbial and Cyto-toxic effect
6. Anti Oxidants effect
7. Hepato-protective effect

Anti Diabetic Activity of Plant

Attaullah et al., (2017) reported the work based on an intensive and extensive study of Pteridophytes of Maindam valley and documented the ethanobotanical uses of Adiantum incisum forsk and other also reveal the traditionally uses and treatment of different health disorders. The frond is powdered, mixed with butter and are used to control the internal burning of the stomach also used in fever, cough, diabetes and skin disease [24].

Rai. S. et al., (2016) reported that *Adiantum incisum* is used as remedies in traditional therapy. The plant has an important role in medicine and public health. *Adiantum incisum* is an evergreen fern and mostly found in hilly areas, commonly called trailing maidenhair. Literature survey from books and journals of traditional Indian medicine revealed that *Adiantum incisum* has a lot of medicinal properties. Leaves, stems and whole plant have been reported for medicinal activity. It is used as a remedy to cure like Cough, **Diabetes,** Jaundice, Fever, Diarrhea, Skin diseases and Wounds. The plant has pharmacologically been studied for various activities like hepato-protective, antioxidant, antimicrobial activity, In-vitro α-amylase and α-glucosidase inhibitors etc. However too many scientific studies have been carried out on this plant for exploring these traditional uses [25, 26].

Telagari M. et al., (2015) conducted *in-vitro* α-amylase and α-glucosidase inhibitory activity of *Adiantum incisum Linn* extracts. This study was to provide an *in-vitro* evidence for their **potential role in Diabetes** α-amylase and α-glucosidase enzymes. This study prove that the *A. incisum* is effective α-amylase and α-glucosidase inhibitors, which may helpful to reduce the postprandial glucose levels. However, the principle compounds responsible for the inhibitory action of α-amylase and α-glucosidase [27].

Tanzin R. et al., (2013) reported on the medicinal values of pteridophytes (fern and fern allies) a number of ferns are used in folk medicinal system and by various tribes of the Indian sub-continent for medicinal purposes. It was of interest to determine whether folk medicinal uses of this fern species can be validated through modern scientific methods. Although reports on traditional medicinal uses of fern species are scant, within the Indian sub-continent and especially India, there are a few reports on use of various fern species in folk and tribal medicine. To cite a few instances, *Adiantum capillus-veneris* L. (Adiantaceae) leaf extract are used for fever, cough and bronchial disorders. The plant extract of *Adiantum incisum* Forsk. (Adiantaceae) is used in cough, **diabetes**, and skin diseases also reported to be used in many other diseases [28].

Ansari R. et al., (2012) revealed that *Adiantaceae* family is one of most common plants that have found diverse medicinal uses in the indigenous systems of medicine. The leaves of plant have pharmacologically been studied for various activities like antibacterial, anti-implantation, **anti-hyperglycemic** or **hypoglycemic**, antiviral activities etc. The present report that reviews the entire investigations done on this plant will possibly help to its effective remedies in traditional therapy, and will be the window for its usage in discovery of new drugs [29].

Paul T. et al., (2012) discussed that *Adiantum species* is commonly known as *Maiden hair fern'.* It is widely distributed in many parts of India and used as an ornamental plant. It is ethno-medicinally used in bleeding diseases, burning sensation, erysipelas, epileptic fits, dysentery, and elephantiasis. It has been reported that the dried whole plant has been used as a medicine for bronchitis and cough *Adiantum incisum* possess **antidiabetic potential** which belonging to the same genus and family of Pteridophytes ,there is insufficient information was available regarding anti diabetic potential of *Adiantum incisum* L [30].

Shukla A. et al., (2011) reported that Diabetes mellitus one of the major disorder which is growing at faster rate second after cancer. To avoid such problems herbal medications has greater advantages. Instead of using these types of allopathic formulations, it is beneficial to use Ayurvedic formulations for better management of diabetes mellitus. In this review, around hundred of herbal plants were showing **hypoglycemic activity** and still they are using as traditional remedies for the effective treatment for diabetes mellitus. Herbal plants with antidiabetic activity are *Abroma august* Linn. *Acacia modesta* Wall, *Acacia nilotica* Linn, *Aconitum ferox Wall, Adhatoda vasika Nees, Adiantum capillus-veneris* Linn, *Adiantum incisum* Forsk, *Albizia stipulate Sensu Barker, Alpinia galangal* Wild etc. [31].

Other Pharmacological Activity

Ramakrishnan P. et al., (2017) reported t*o* explore the anti-inflammatory potential of selected Pteridophytes from Western Ghats of South India using heat induced haemolytic activity. Stabilization of RBCs membrane was studied to further establish the mechanism of anti-inflammatory action of A. incisum. This study suggested that further studies on the isolation of active principles from the aqueous extracts of *A. incisum* may bring out an alternative drug for the inflammation. This effect may possibly inhibit the release of lysosomal content of neutrophils at the site of inflammation. The extracts which can inhibit the denaturation greater than 20% over the range concentration were considered as having anti-inflammatory property and *A. incisum* showed more than 20% of inhibition. This provides evidence for membrane stabilization as an additional mechanism of their anti inflammatory effect [32, 33].

Khanum S. et al., (2016) reported that all the extracts showed significant antimicrobial activity towards both bacteria and fungi suggested the presence of antimicrobial compounds. The three extracts of *A. incisum*, the chloroform extract exhibited more antibacterial potential than the n-hexane & carbon tetra-chloride extracts. In case of antifungal activity all the three extract showed almost same potential. This extract showed very good antimicrobial activity against the Gram-(-) *Escherichia coli* (14 mm), *Shigella boydii* (13 mm) and the Gram-(+) *Bacillus subtilis* (12 mm), *Staphylococcus aureus* (14 mm) bacteria with an average zone of inhibition of 8-14 mm. Among the three fractions, n-hexane extract showed significant cytotoxicity than carbon tetra-chloride and chloroform extracts of *A. incisum*. Among In case of antifungal activity all the three extract showed almost same potential. Among In case of antifungal activity all the three extract showed almost same potential [34].

Dildar A., *et al*.; (2015) reported the antioxidant and antimicrobial of methanolic, hexanic, and aqueous extracts of *A. incisum* leaves. The plant was analyzed for phenolic, flavonoid contents and antioxidant and antimicrobial potential. The study define that Methanol is a better solvent to extract most of the antioxidant components from *A. incisum* leaves. In the DPPH assay, the aqueous extract exhibited a slightly higher antioxidant activity than the methanolic. The aqueous extract was the most potent and the hexanic the least. *P. aeruginosa* was the most susceptible strain, while the aqueous and methanolic extracts exhibited a slightly higher efficacy against this pathogen than the drug amoxicillin [35].

Frank RP. et al., (2012) reported the hepato-protective effect of *A. incisum* forssk extract against CCl_4 induced hepatotoxicity in rats. The treatment with *A. incisum* for normalized various biochemical parameter of oxidative stress and was compared with standard drug. This study show that *A. incisum* can be proposed to protect the liver against CCl_4 induced liver damage in rats and the hepato-protective effect might be correlated with its antioxidant and free radical scavenger effect. The hepato-protective effect of *A. incisum* extract of *A. incisum* was confirmed by histological examination of liver issue of control and treated animals. The methanolic extract of *A. incisum* extract revealed significant protection in hepatocyte regeneration against the toxic effect of CCl_4 and found to be more potent and effective hepatoprotective activity [36].

Bhatia D. et al., (2010) reported the effects of crude extract, both alcoholic and decoction of whole plant of Adiantum extract was observed on the reproductive structures of male albino rat on testis, epididymis, vas deferens and accessory reproductive organs. This Study revealed arrest of spermatogenesis at the spermatogonial stage. It may be because of the effect of the treatment on the circulating levels of LH and FSH which resulted in the lowering of testosterone levels indicating anti-androgenic activity. It seems that the extracts exert their effect on spermatogenesis through the alteration of the hypothalamus pitutary-gonadal axis function and regulation. The agents on these accessory sex organs, resulting in inhibition of the contributing factors for sperm activation and vitality. The treatment of rats with these agents does not cause any permanent genetical loss that is one of the main and key areas of concern for any contraceptive to be safe. The study reveals that Adiantum extract could be possibly exploited pharmacologically to develop a safer, effective and reversible male antifertility agent(s) [37].

Parihar P.et al., (2009) being reported that nearly all the leaves extracts have shown inhibitory effect against the bacterial strains. The study conducted to show antibacterial effect of alcoholic and aqueous extract of *A. incisum* forsk. It was also found that aqueous and alcoholic extract of leaves of *A. incisum* extracts have shown inhibitory effect against S. typhi. It also showed an inhibition against A. tumefaciens and many other gram negative bacteria. The pteridophytic plants are considered to be the disease free plants and are being used ethanobotanically by various tribal communities. These plants are further screened for their in vivo potential as well as for their drug properties. *A. incisum* extracts were more competent than the selected antibiotic [38].

CONCLUSION

The research for alternate remedies (from the plant kingdom) for various disorders will continue all over the world as the various diseases showing many challenges not only to the physician but also to the researcher. The present review reveals that *A. incisum* are being used traditionally to treat Diabetes, body swellings, skin diseases, body pains, arthritis, hepatoprotective, analgesic, and anti-inflammatory and to treat liver disorders. The drug has been studied for different pharmacological actions using animal models with good convincing results. No acute or chronic toxicity has been reported. But still, studies on various traditional uses are lacking. The present review would further help for the renaissance of other pharmacological activities on the fern and can also give a lead to take clinical studies based on present reported activities.

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Nil

Conflicts of Interest

Nil

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