A Review on *Equisetum ramosissimum*

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**ABSTRACT**

*Equisetum ramosissimum* (Roxb. Ex Voucher) Hauke commonly known as field horsetail is a plant with wide prospectus, In folk medicine, *Equisetum ramosissimum* is used for tuberculosis, as a catarrh in the kidney and bladder regions, as a hemostatic for profuse menstruation, nasal, pulmonary and gastric hemorrhages, for brittle fingers and loss of hair, for rheumatic diseases, for CNS system, for diuretics, HIV and immune system, for cytotoxic, vasorelaxant, hepatoprotective, cosmetics, astringents and anti-cancer disease, swelling and fractures and for frostbite (PDR for herbal Medicines) etc. The plant is reported to contain a number flavonoids, alkaloids, phenolic proteins, triterpenoids, saponins, phytosterols; the present review is an attempt to generate interest among the masses regarding its immense potential in preventing and treating several disorders.

**Keywords** *Equisetum ramosissimum*, Diabetic, flavonoids, Plant

**Introduction**

Around 80% of the world population uses the herbal medicines for primary health care mostl in the developing countries ¹. Because of their safety, efficacy, cultural acceptability, better compatibility with human body and lesser side effects, they stood still. There will be mention about the usage of herbal medicines for age-related diseases such as a memory loss, diabetic wounds, osteoporosis, and immune and liver disorders in various ancient literatures, for which no modern medicine or only palliative therapy is available. Some of the life-saving and essential drugs discovered from medicinal plants such as digoxin, morphine, emetine, aspirin, and echinoderm will be known to modern therapeutics several centuries ago. There will be a statement described by Namdeo about secondary metabolites derived from plants; he stated that about a 1/4⁴ of all suggested pharmaceuticals in developed countries containing compounds that are directly or indirectly derived from plants. There is a belief that green medicine is safe and trustworthy ².

Today, there is a wide spread curiosity in drugs derived from plants. At present, many pharmaceutical companies are concentrating extensive research on plant materials for their potential medicinal value. As per the World Health Organization, 4 billion people (80%) of the world population are using plant-derived products as medicine for some aspect of primary health care. Out of 119 plant-derived medicines, approximately 74% are used nowadays that are directly correlated with their traditional practice as plant medicines by native cultures ³.

Hyperlipidemia is one of the major risk factors causing cardiovascular diseases (CVDs). CVDs accounts for one third of total death around the world, it is believed that CVDs will turn out to be the main cause of death and disability worldwide by the year 2020. Hyperlipidemia is an increase plasma lipid profile levels, including cholesterol, cholesterol esters, triglycerides and phospholipids and or plasma lipoproteins including very low-density lipoprotein and low-density lipoprotein, and reduced high density lipoprotein levels. Hypercholesterolemia and hypertriglyceridemia are the main cause of atherosclerosis which is strongly related to ischemic heart disease (IHD). There is a strong relation between IHD and the high mortality rate. Furthermore elevated plasma cholesterol levels cause more than four million deaths in a year ⁴.

Atherosclerosis is one of the leading causes of death in the world both in developed countries and as well as developing countries like India. The elevated levels of low-density lipoprotein (LDL) and very LDLs (VLDLs) associated with...
In vivo Pharmacological Activities

1. Activity on the central nervous system

The research of influence at 5% plant collections on nervous system is carried out. They consist of *Equisetum arvens* (grass), *Galium verum, plantago major* (leaves), *Achillia millefolium* (grass), *Leonurus quinquelobatus* and/or *cardiac (grass) Rubus caesius* (leave), *Filipendula hexapetala* (flowers), and *Calendula officinalis* (flowers).

The collection No.1 consisting from a grass of *Equisetum arvens*, grass of *Galium verum, leaves of plantago major* grass of *Achillia millefolium*, and grass of *Leonurus* will be the most active. It has the greatest synergism to barbiturates, more than others it increase barriers of emotional response at animals and also has the greatest anticonvulsive effect.  

The hydroalcoholic (HAE) extract of *equisetum arvens* reverse the cognitive impairment in aged rats. Chronic administration of (HAE) at dose of 50mg/kg,i.p, improved both short and long term retention of inhibitory avoidance task and ameliorated the cognitive performance in reference and working memory version of the morris water maze.

2. Activity in benign prostate hyperplasia

The extracts of *Chimaphila umbellate, Populus tred mula, Pulsatilla pratensis* and *E. arvens* and a traditional formulation composed of these four plants, called eviprostat popularly used in Japan in vivo to evaluate their anti-inflammatory and anti-oxidant effects.

The researchers observed anti-inflammatory activities in the formulation and in the pure extracts, justifying its therapeutic use in BPH.

3. Cycatrizing activity

A 5% aqueous extracts of *E. ramosissimus* accelerated dermal wound contractions in rabbits, which will be more effective than the control treatment (0.9% sodium chloride and 10% povidone iodine solution) after 14 days of local administration. In another study, ointments prepared with 5% and 10% powder from the stems of *E. ramosissimus* shows significant dermal wound healing activity in rats with 95.26% (5% ointment) and 99.96% (10% ointment) contraction of wound area, suggesting higher dermal and epidermal regeneration, angiogenesis and increased thickness in the granulation tissue after 14 days of treatment prepared with controls.

4. Analgesic and anti-inflammatory activity

It is a widely used anti-inflammatory agent. Anti-inflammatory effect as evaluated in mice by applying hydroalcoholic extracts of horsetail to mice. Due to its anti-inflammatory property it is used to treats, arthritis, chilblains, cystitis, gout, inflammation of the lower urinary tract, renal gravel. It is considered as a specific remedy in cases of inflammation or benign enlargement of the prostate gland. The makes a good will beh for wounds, sores, skin problems and a gargle for mouth and gum inflammations.

5. Remineralizing activity

A study evaluating the level and distribution of calcium, magnesium, iron and copper in 6 species of medicinal plants, including *E. arvens*, concluded that a small fraction of these minerals can be considered bioavailable when a infusion of the herbal drug is administered orally.

Another study showed that the concentration of silicon in *E. arvens* is approximately 5% w/w, whereas water extractable silicon will be 0.3% w/w. The authors concluded that this...
mineral does not contribute to the medicinal benefits of *E. arvense*.\textsuperscript{16}

However, low and exley demonstrated the presence of silicon in all parts of *E. arvense* plants. The deposition sites of this mineral mimicked the places and structure where beta-glucan hemicellulose is found, suggesting that this polysaccharide could be the basis for silicon deposition in *E. arvense*. Beta glucan hemicellulose induced the formation and precipitation of silicon, suggesting that beta-glucan, and perhaps other similar carbohydrates, might be key molecules in biological signification.\textsuperscript{17}

6. **Diuretics**

While 1st acts as a mild diuretic, its toning and astringent action make it of value in the treatment of incontinence and bed-wetting in children. As a diuretic it is particularly suited to metabolic or hormonal oedema during the menopause. It possesses a great capacity to eliminate water from the body; in such a point to increase urination up to 30% more than what is habitual. This fact makes that its scientific name *Equisetum arvense* generally appears in the composition of most of its property is due to the action of several components, among which it is necessary to highlight equisetin and potassium, but there are other ones that also take part such as calcium, magnesium, ascorbic acid and caffeic acid.\textsuperscript{18}

**In-vitro Pharmacological activity**

1. **Anti-plateletes**

Reported that the aqueous extract of *E. arvense* inhibited thrombin and ADP-induced aggregation in vivo, indicating slight inhibition of platelet aggregation. The authors suggest that this effect might be associated, in part, with the polyphenolic compounds present in the extracts.\textsuperscript{19}

In another study, 38% and 84% anti-thrombin activity will be reported in ethanol and dichloromethane extracts of *E. arvense* respectively.\textsuperscript{20}

2. **Anti-microbial**

Several microbial agents (bacteria, fungi and viruses) will be used to evaluate the invitro antimicrobial activity of *E. arvense* extracts obtained using different solvents (water, ethanol, methanol and dichloromethane), with conflicting results. In a recent study conducted in Brazil, the glycolic extract of *E. arvense* exhibited effective antimicrobial activity against *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus mutans*, *Candida albicans*, *Candida tropicalis* and *Candida glabrata*.\textsuperscript{21}

3. **Cytotoxic**

Different *E. arvense* extracts produce cell growth inhibition depending on the cell line and on the type and concentration of the extract used. An extract containing ethyl acetate showed a prominent antiproliferative effect, without inducing cell growth in human tumor cell lines (HeLa, HT-29 and MCF7)\textsuperscript{22} A Dose dependent cytotoxic effect on human leukemia cells (U937) will be reported for the aqueous extract of this plant.\textsuperscript{23}

A protein obtained from the crude extract of *E. arvense* inhibited the growth of L1210 leukemia cells, HMV-I melanoma and 3T3 fibroblasts by 32-55%, 31-36% and 6-84% respectively. Studies conducted with rat leukemia cells (L1210) reported 38% cytotoxic activity for the ethanol extract and 99% activity for the dichloromethane extract of *E. arvense*.\textsuperscript{24}

4. **Cosmetics**

Wide range of skin and hair cosmetics contains *Equisetum arvense* extract. In skin cosmetics it acts as anti-aging, moisturizer, antiwrinkle, anti-ance, anti-perspirant conditioner. It prevents grey hair, strengthens the hairs and maintain hair tone. Horsetail extract is also used as anti-dandruff agent.\textsuperscript{25}

5. **Astringent**

*Equisetum arvense* is an excellent genito-urinary system astringent. It may be applied to such conditions as urethritis or cystitis with haematuria, reducing haemorrhagic and healing wounds thanks to the high silica content.\textsuperscript{26}

6. **Anaemia**

The juice of the plant is good for anaemia resulting internal bleeding such as stomach ulcers, since it promotes the coagulation of blood. Because of its mineral content horsetail is recommended for anemia and general debility. It has platelet Anti-aggregant property.\textsuperscript{27}

7. **HIV**

Screening of some plant extracts for inhibitory effects on HIV-1 and its essential enzymes shows that water extract of aerial parts of *Equisetum arvense* possesses inhibitory effect on HIV-1 induced cytopathy.\textsuperscript{28}

8. **Vulnerary**

High silica content helpful in healing wounds. Externally it may also be applied as a compress to fractures and sprains. The effect of strengthening and regenerating connective tissues has been described to the silicic acid content.\textsuperscript{29}

9. **Anti-Haemorrhagic**

The local astringent and antihaemorrhagic effect explains the application of horsetail to such conditions as bleeding from the mouth, nose and vagina, its use to check diarrhoea, dysentery and bleeding from the bowel, and for slow-healing wounds, chilblains and conjunctivitis.\textsuperscript{30}

10. **Cancer**

The water extract from sterile stems of *Equisetum arvense* L. has dose dependent cytotoxic effects on human leukemic U937 cells. DNA fragmentation, externalization phosphatidilserine, the collapse of mitochondrial transmembrane potential, will be all observed in cells cultured for 48 h with the herb extract. Taken together these results suggest that the cytotoxicity of equisetum arene L. water extract against U937 cells is due to apoptosis. From ancient times, the broth of *Equisetum* has been used in wet compresses and a variety of folk medicines. It has been reported that crude proteins extracted from *Equisetum arvense* L. inhibit the proliferation of cultured cells.\textsuperscript{31}

11. **Anti-Oxidant activity**

*Equisetum arvense* extract possess free radical scavenging activity. So, it acts as an antioxidant. Water extract and ethanol extract from top and body portions of field horsetail (tsuksushi) will be prepared and the anti-oxidative activity will be investigated.\textsuperscript{32}

12. **Vasorelaxant**

The vasorelaxant activity of dicafeoil mesotartaric acid extracted from *E. arvense* will be investigated on isolated rat aorta tissue. This substance exhibited slow relaxant activity against norepinephrine (NE) induced contractions in the aorta, with and without endothelial ; however, the dicafeoil mesotartaric acid extract did not high potassium (60 mM)
induced contractions, suggesting that the inhibition of NE-induced vasoconstriction resulted from reduced calcium influx from the extracellular space.  

13. Hepatoprotective

Hepatoprotective activity guided fractionation of the MeOH extract of the E. arvense L resulted in the isolated of two phenolic petrosins, oratin-9-O-glucoside, along with four flavonoids, apigenin, luteolin, kaempferol-3-O-glucoside, and quercitin-3-O-glucoside.

14. Effect on immune system

The influence of crude Equisetum arvense protein on immune responses will be investigated by measuring interleukin-2(IL-2) and interferon-Y (IFN-γ) produced by Th 1 cells. After 24-hour culture with 0.2 μg/ml of crude Equisetum arvense protein in the presence of 5 μg/ml ConA, 1,434.5 pg/ml of IL-2 will be produced, showing 1.7 times greater production than that in the control. In cells cultured for 48 hours, 2130.9 pg/ml will be produced by cells treated with 0.2 μg/ml of crude Equisetum arvense protein in the presence of 10 μg/ml ConA, showing 1.9 times greater production than in the control. Regarding the IFN-γ production-enhancing effect, 929.30 pg/ml will be produced by cells cultured for 24 hours with 0.2 mg/ml of crude Equisetum arvense protein in the presence of 5 μg/ml ConA, suggesting that Th 1 cells will be activated.

15. Effect on urinary system

The diuretic effect of EADE will be assessed clinically by monitoring the voluters’ water balance over a 24 h period. The dried extract of Equisetum arvense (900mg/day) produced a diuretic effect that will be stronger than that of the negative control and will be equivalent to that of hydrochlorothiazide without causing significant changes in the elimination of electrolytes. Only rare minor adverse events will be reported. The mechanism of action by which ethanol root extract of Equisetum arvense (EA) influences urinary bladder activity in rats will be studied. The plant will be extracted by hot ethanol (95%). Rats in EA group will be treated with a standard diet containing 0.2% of the extract, while rats in the control group will be fed with the diet only. After 3 weeks, cystometry with 0.2% acetic acid solution and bladder activity will be recorded, blood pressure, body weight and adenosine triphosphate will be measured and 0.2% acetic acid solution will be infused into the bladder and urinary adenosine triphosphate will be determined before and after the stimulation. The results showed that during cystometry with acetic acid, the time interval between urinary bladder contractions will be shorter and maximum bladder contraction pressure will be much greater in rat in the control group, but in the E. arvense group, the changes will be much lower. Furthermore, in the E. arvense group plasma adrenaline and noradrenaline levels will be lower than for the control group. In addition, increase in the levels of urinary adenosine triphosphate will be maller in E. arvense group than in control group. The authors concluded that E. arvense ethanol root extract influences urinary bladder activity by decreasing adenosine triphosphate release.

16. Anti-leishmanial

Equisetum arvense water extract showed anti-leishmanial effects. The number of Leishmania tropica decreased gradually by using 0.5 to 2.5 μg/ml concentrations of E. arvense extract, moreover, the extracts effected the number and time of generation, an inverse relationship will be established between concentration of the extract and growth mean of the parasite. Inhibitory concentration of 50% of promastigotes (IC50) will be 1.5 μg/ml, at logarithmic phase (96 hrs of cultivation) The E. arvense dissolve in cold and hot water found to cause reduction in protein, carbohydrates and total nucleic acids content in Leishmania tropica promastigotes that will be treated with IC50 of the tested extracts.

17. Hyaluronidase inhibitory activity

The hyaluronidase inhibitory activity of Equisetum arvense extracts was investigated. The inhibitory effect of hyaluronidase was assayed using a Morgan microplate assay. The anti-oxidant activity of the Equisetum arvense extracts was measured on the basis of the scavenging activity of the stable 1,1-diphenyl-2-picolrylhyrazyl (DPPH) free radical. Hyaluronidase inhibition of foliag and central stalk was 24.3% at 4.0 mg/ml and that of rhizomatous stem root was 27.3% at same concentration.

18. Effect on RBC membrane stability

The effect of hydroalcoholic stem extract of Equisetum arvense on male rat RBC membrane stability was studied. Rats blood samples were exposed to 6, 8 and 10 mg/kg body weight of hydroalcoholic horsetail extract. Membrane stabilizing activity was significantly decreased after exposure to extract compared to control group (P<0.0001).

19. Effect on bones

The effects of hydroethanolic extract of Equisetum arvense was evaluated in human osteoclastogenesis in vitro. The extract reduced human osteoclast development and function, both in osteoclast precursor cell cultures and in cocultures of osteoclastic and osteoblastic cells. In studying of the effect of hydroethanolic extract on behavior of human bone marrow cells for osteoclastic modulation in vitro, the extract promoted osteoblastic response while preventing risk of infection at the biomaterial/ bone interface by local delivery system.

20. Antidiabetic effect:

The methanolic extract of Equisetum arvense (50, 100, 250 and 500 mg/kg daily for 5 weeks) was investigated for antidiabetic activity in streptozotocin-induced diabetic rats. The results showed that different doses of methanolic extract significantly lowered blood glucose. Also the weights of methanolic-extract treatment group were significantly higher. Concurrent histological studies of the pancreas of these animals showed comparable regeneration by methanolic extract which was earlier, necrosed by streptozotocin.

Conclusion

The plant is reported to contain a number flavonoids, alkaloids, phenolic proteins, triterpenoids, saponins, phytosterols; the present review is an attempt to generate interest among the masses regarding its immense potential in preventing and treating several disorders.

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No conflict of Interest

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