Anti inflammatory profile of *Harpagophytum procumbens* commonly known as Devils claw – AN update

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Running title : Anti inflammatory actions of *Harpagophytum procumbens*

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ABSTRACT

*Harpagophytum procumbens*, also known as devil’s claw commonly known as Salai Guggul in Sanskrit. The various parts of the plant are used for the treatment of several illnesses like fever, skin diseases, gastrointestinal upset and arthritis. The main chemical constituents of *H.procumbens* are the secondary tuberised roots. Harpagoside was the first glycoside to be isolated from *Harpagophytum procumbens* and is widely regarded as the main active constituent. *H.procumbens* belongs to the sesame seed family *Pedaliaceae*. Harpagide is another glycoside which was discovered at the same time. A third glycoside namely the procumbine was isolated. Depending upon various scientific researches, the aim of this article is to focus on the analgesic and anti-inflammatory action by compiling various research studies.

KEYWORDS

*Harpagophytum procumbens*, Interleukin, Harpagoside, Procumbine, Leucocyte.
INTRODUCTION

Harpagophytum procumbens has spiny fruits which gives rise to its common names 'devil’s claw' and 'grapple plant'.[1] The fruits consists of hooks which get entangled in the furs and grooves of animals and aids in dispersal of the seeds. Harpagophytum is a Greek translation of the common name 'grapple plant'. Procumbens means prostrate, which in turn refers to the creeping stems of the plant. Over the past few centuries the Harpagophytum procumbens have been used by the people as a medicinal plant to treat a variety of illnesses like digestive system disorders, infections and sores.

Root extracts of the H. procumbens contain the iridoid glycoside, harpagoside, which is very much effective in the treatment of degenerative rheumatoid arthritis, osteoarthritis, tendonitis, kidney inflammation and heart disease. [2] Tubers are collected by local people across Southern Africa, and sold for export.

BOTANICAL DESCRIPTION

H. procumbens is now widely used as an herbal medicine for its anti-inflammatory and analgesic properties. Harpagophytum procumbens is a perennial herb with a succulent taproot. [3] The annual, creeping stems can be up to 2 m long. They grow from a mother tuber whose taproot can be up to 2 m deep. Secondary tubers develop on fleshy roots growing from the primary tuber. These tubers can be up to 25 cm in length and 6 cm thick. [4] The secondary tubers contain stachyose, which can adapt to drought conditions. [5] The leaves are simple and opposite, up to 6.5 cm long and 4 cm wide. They are shallowly lobed. The flowers are tubular in shape 5-6 cm long, and are light purple or pink in color, but yellow inside the tube. [6] The fruits are large, up to 15 cm in diameter, and have four rows of curved arms with recurved spines. The seeds are dark brown or black in color. [7]

TAXONOMIC HIERARCHY

Kingdom- Plantae

Subkingdom- Viridiplantae

Infra kingdom- Streptophyta

Superdivision- Embryophyta

Division- Tracheophyta

Subdivision- Spermatophyta

Class- Magnoliopsida
Superorder- Asteranae

Order- Lamiales

Family- Pedaliaceae

Genus- Harpagophytum

Species- Harpagophytum procumbens

Fig 1: Harpagophytum procumbens

PHYTOCHEMICAL CONSTITUENTS

The first glycoside to be isolated from *Harpagophytum procumbens* is harpagoside in 1962. Harpagide and procumbine are the other active constituents. In addition to these, three types of iridoid glycosides were discovered which were having different linkages. The synthesis of iridoids is mainly through the mevalonic acid pathway and are technically known as cyclopentan-c-pyran monoterpenoids. Flavonoids is the another type of active constituent which includes the luteolin and kaempferol. Chlorogenic acid, cinnamic acid and caffeic acid are categorized under the phenolic acid groups which play a major role. Other constituents include the harpagoquinone and stigmasterol and beta-sitosterol belonging to the quinones and phytosterols group respectively. *H. procumbens* also consists of tetrasaccharide stachyose, smaller amounts of raffinose, sucrose and monosaccharides. Acetoside, triterpenes, gum resins and other minerals like calcium, iron, chromium, manganese, magnesium, potassium are also present.
ANALGESIC ACTION OF *H. procumbens*

The *H. procumbens* can relieve pain from arthritis, lower back, knee and hip pain. It also has been used to treat osteoarthritis, rheumatoid arthritis, gout, bursitis, tendonitis and soft tissue pain like muscle aches. Intake of over-the-counter drugs like ibuprofen and acetaminophen can lead to severe liver and stomach problems which can be overcome by using *H. procumbens* as an alternative. [13]

ANTI-INFLAMMATORY ACTION

Several *in vitro* studies have been supportive of the anti-inflammatory action of *H. procumbens*. [14-15] It acts by inhibition of COX-2 enzymes and proinflammatory enzymes, antioxidant activity, reductions in expression of prostaglandin PGE₂ and inhibition of cysteinyl leukotrienes. [16-18] The anti-inflammatory action of *H. procumbens* was found to be greater than the non steroid anti-inflammatory drugs such as phenylbutazone and indomethacin while its analgesic effects compared favorably to acetylsalicylic acid. [19-20] The extract of the *H. procumbens* was known to prevent the LPS-induced synthesis of tumor necrosis factor alpha in stimulated primary human monocytes. [21]

ANTIOXIDANT PROPERTY

Several research studies have proposed that the oxidative free radicals may be ultimately responsible for the induction of inflammation and may be an important factor for the onset of inflammatory disease like rheumatoid arthritis. Polymorph nuclear leucocytes produce oxidative free radicals which in turn contribute to the pathogenesis of the arthritic disease. The prostaglandin synthesis will be activated and cause direct injury to the cell thereby altering the biochemical, biophysical and structural properties of the cellular proteins such as elastin, collagen and polysaccharides. This eventually leads to degradation of the cartilage and reduce the viscosity of the synovial fluid. Anti-oxidant protection in the form of superoxide dismutase, catalase, glutathione peroxidase is absent in the human synovial tissue thereby allowing the oxidative free radicals to potentially damage resulting in lipid peroxidation and other consequences. [22]

ANTI-CANCER EFFECTS

Various anti-inflammatory agents have been shown to exert chemo preventive activity by targeting the cyclooxygenase (COX)-2 which is a rate limiting enzyme involved in the process of inflammation. The *H. procumbens* extract when applied topically inhibited the TPA-induced COX-2 expression. The extract of the *Harpagophytum procumbens* also diminished the TPA-stimulated catalytic activity of extracellular signal regulated protein kinase which is known to regulate the activation of eukaryotic transcription factors mediating COX-2 induction. [23]

GASTROINTESTINAL EFFECTS

*Harpagophytum procumbens* is reported to have a bitter action similar to that of gentian root. [24] These effects are due to the iridoid glycosides which cause reflex stimulation of the digestive processes. [25] In addition to these actions, several research were conducted which has shown
that it activates liver function, thereby promoting detoxification of toxins such as urea. **Error! Bookmark not defined.** It has also proven useful for reducing raised cholesterol and neutral fat levels in patients with metabolic disorders. [26]

There are other gastrointestinal benefit of *Harpagophytum procumbens* which is used in the treatment of a various digestive disturbances including dyspeptic conditions of the upper epigastrium, intestinal upsets, and liver and gall bladder complaints either with or without the involvement of the pancreas. [27]

**BENEFITS OF H.PROCUMBENS**

Loss of articular cartilage is an important etiological factor in arthritis and osteoarthritis due to an imbalance between the synthesis and degradation of the extracellular cartilage matrix. These diseases are accompanied by an increased induction of cytokines such as interleukin 1 beta and tumor necrosis factor alpha.

The increased releases of cytokines leads to an enhanced production of matrix-degrading enzymes like for example, the matrix metalloproteinase. Western blot analysis showed that the *H.procumbens* extracts effectively decreased the production of matrixmetalloproteins in chondrocytes.[28] Harpagoside of *H.procumbens* is able to interfere with the mechanisms that regulate the influx of calcium in the smooth muscle cells. [29]

Wegener T. recommended *Harpagophytum procumbens* as a supportive treatment for degenerative painful rheumatism, as *H.procumbens* has benefits of analgesic and anti-inflammatory actions. [30]

**CONCLUSION**

*Harpagophytum procumbens* has got various benefits in the human body. It has been used for treating several illnesses like rheumatoid arthritis, osteoarthritis, tendonitis and other gastrointestinal disturbances. Hence, it can be used as the natural medicine in curing several diseases as it has got various medicinal effects.

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