Horsetail

**BOTANY**

*Equisetum arvense* L., common name *horsetail*, is a perennial, rhizomatous, creeping plant, member of the Equisetaceae family. This plant has two different types of stems: yellowish-brown fertile stems, 10-20 cm tall, with sporangiferous spikes at the tip, appearing by the end of winter or during the spring; and green sterile stems, 20-80 cm tall, which appear by the middle of the summer and die by the beginning of winter. Both types of stem are hollow, furrowed and with jointed segments bearing verticillate ramifications. This plant lacks flowers; propagation is through spores. Horsetail is native to Europe, a descendant of the giant ancestors that grew forming large forests during the Mesozoic Era. At present, horsetail grows abundantly in meadows, on clayish, sandy, humid soils; it grows wild by the roadsides, riversides and in open fields. There is some small-scale cultivation in eastern Europe.

Horsetail extract is produced from the stems of *Equisetum arvense*.

**CHEMISTRY**

**Mineral salts**

15-25%. *E. arvense* stems are rich in mineral salts, particularly silicon (5-10%). Additionally potassium, calcium, phosphorus and manganese (scarcely) salts can be found, as well as water soluble silicon derivatives.

**Flavonoids**

Horsetail has a number of flavonoids, including quercetin, isoquercetin, kaempferol (and its derivatives), galuteolin and equisetrin.

**Saponins**

Equisetinon (5%); this saponin produces arabinose, fructose and equisetogenin upon hydrolysis.
**Other active principles**
Traces of alkaloids (nicotin, 3-methoxypyridin, equisetine, palustrinine and palustrine), tannins, phytosterols (β-sitosterol, campesterol, isofucosterol), fatty acids (linoleic, linolic and oleic), aconitinic acid (equisetic acid), benzoic acid, malic acid, gallic acid, citric acid, pectic acid, vitamin C (0.072%), resin, lignans (caffeic acid, ferulic acid, dicafeoil-mesotartaric acid and p-coumarinic acid).

**TRADITIONAL USES**
Horsetail has traditionally been used as a diuretic, haemostatic and re-mineraliser. At first it was believed that the diuretic activity was caused by the inorganic elements of the plant (silicon), but today it seems to have been demonstrated that the action is caused by the flavonoids and saponins. It has a considerable haemostatic and cicatrising action and has therefore been used traditionally to treat certain haemorrhages. Its remineralising action must also be stressed, caused by the silicon content.

**COSMETIC PROPERTIES**
**Activity on the connective tissue**
Horsetail provides water soluble silicon, easily absorbable by the organism, better than other galenic forms. In humans, silicon is involved in collagen synthesis and contributes consistence and hardness to structures such as bones, tendons, nails, hair, cartilage, cornea, etc. (Alonso J, 2004).

Skin owes its flexibility to the presence of collagen and elastin fibres that are poorly renewed as we get older, which results in a slackening of the cutaneous tissue, wrinkles, etc. It has been seen that silicon helps to maintain the amount of collagen and elastin fibres, so it would be useful to preserve the structural integrity and development of connective tissue and to delay skin ageing.

Seaborn CD & Nielsen FH (2002) showed that silicon (Si) deprivation decreased the collagen concentration in bone of 9-week-old rats. Finding that Si deprivation also affects collagen at different stages in bone development, collagen-forming enzymes, or collagen deposition in other tissues would have implications that Si is important for both wound healing and bone formation. Therefore, 42 rats in experiment 1 and 24 rats in experiment 2 were fed a basal diet containing 2 or 2.6 µg Si/g, respectively, based on ground corn and casein, and supplemented with either 0 or 10 µg Si/g as sodium metasilicate. At 3 week, the femur was removed from 18 of the 42 rats in experiment 1 for hydroxyproline analysis. A polyvinyl sponge was implanted beneath the skin of the upper back of each of the 24 remaining rats. Sixteen hours before termination and 2 week after the sponge had been implanted, each rat was given an oral dose of $^{14}$C-proline (1.8 µCi/100 g body wt). The total amount of hydroxyproline was significantly lower in the tibia and sponges taken from Si-deficient animals than Si-supplemented rats. The disintegrations per minute of $^{14}$C-proline were significantly higher in sponge extracts from Si-deficient rats than Si-supplemented rats. Additional evidence of aberrations in proline metabolism with Si deprivation was that liver ornithine aminotransferase was significantly decreased in Si-deprived animals in experiment 2. Findings of an increased accumulation of $^{14}$C-proline and decreased total hydroxyproline in implanted sponges and decreased activity of a key enzyme in proline synthesis (liver ornithine aminotransferase) in Si-deprived animals indicates an aberration in the formation of collagen from proline in sites other than bone that is corrected by Si. This suggests that Si is a nutrient of concern in wound healing as well as bone formation.

Additional to silicon stimulating action on collagen synthesis, tannins exert an astringent activity, which restricts fluid loss and prevents external damages, thus promoting tissue regeneration (epithelization) in cases of superficial wounds and burns Bruneton J., 2001).

Therefore, horsetail is recommendable to formulate cosmetic products with epithelising and firming activity.
Activity on blood circulation
Silicon is an integral part of blood vessel walls: its presence is essential for synthesizing elastin and collagen fibers. It therefore helps conserve the elasticity of blood vessels. This property and its contractibility are two important characteristics for the proper function of the blood circulation. Silicon must also be present for vascular tone.

Flavonoids are vein-active and vessel-protective agents because they reduce the permeability and increase the resistance of blood capillaries. Flavonoids are used in the treatment of blood vessels disorders such as varices, chronic venous insufficiency (CVI), low capillary resistance, etc. Their protective effect is due to their high affinity for proline-rich proteins, such as collagen and elastin. Since these proteins are structural components of veins, their degradation weakens the blood vessels, inducing edema and swelling of the lower limbs (Bruneton, 2001).

Therefore, horsetail extract is of great use to formulate cosmetic products aimed at improving general blood circulation.

Remineralizing activity
Horsetail is very interesting from the medicinal point of view because of its remineralizing activity. This action is due to its mineral content, especially silicon. The cosmetic use of horsetail is focused on helping the skin find its natural balance, on the basis of the mineral and vitamin content of this plant. These elements provide a natural way to recover skin vitality and to enhance the skin appearance.

Thus horsetail extract is highly recommendable to formulate cosmetic products with skin stimulating and revitalizing activity.

Astringent activity
This activity is due to the tannin content of horsetail. The astringent action of tannins is due to their capacity to form complexes with different substances. Applied topically, tannins coat the outermost layers of skin and mucosa, thus protecting the deeper layers (Bruneton J., 2001).

Therefore, horsetail extract is recommended to formulate cosmetic products with regulatory activity on sebum secretion.

Diuretic activity
The mineral salts content of this plant, together with equisetomin, flavonoids and gallic acid, synergically act as a mild diuretic (aquaretic), without modifying the hydroelectrolytic balance (Alonso J, 2004).

Therefore, horsetail extract is attributed tissue disinfilrating and draining properties.

Finally, we would like to mention that the reference publication Plant preparations used as ingredients of cosmetics products. Vol.I (Council of Europe Press, 1994) includes a monograph on the glycolic extract of the sterile stems of Equisetum arvense L., where the following cosmetic effects and maximum concentration in cosmetic products are attributed to it:

- elasticizing, astringent, sebostatic
  - up to 10% in products for massage, skin restoring elasticity (striae, wrinkles), antiperspirants, hair lotions (hair loss), greasy skins
- other possible effects
  - remineralising agent, antihaemorrhagic, disinfilrating agent, tissue drainage
COSMETIC APPLICATIONS

<table>
<thead>
<tr>
<th>Action</th>
<th>Active</th>
<th>Cosmetic application</th>
</tr>
</thead>
<tbody>
<tr>
<td>On connective tissue</td>
<td>Mineral salts (silicon)</td>
<td>-Firming</td>
</tr>
<tr>
<td></td>
<td>Tannins</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Epithelizing</td>
</tr>
<tr>
<td>On blood circulation</td>
<td>Mineral salts (silicon)</td>
<td>-Blood flow stimulation</td>
</tr>
<tr>
<td></td>
<td>Flavonoids</td>
<td>-Decongestant</td>
</tr>
<tr>
<td>Remineralizing</td>
<td>Mineral salts</td>
<td>-Stimulant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Revitalizing</td>
</tr>
<tr>
<td>Astringent</td>
<td>Tannins</td>
<td>-Sebum-regulator</td>
</tr>
<tr>
<td>Diuretic</td>
<td>Flavonoids Saponins</td>
<td>-Disinfiltrating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Draining</td>
</tr>
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RECOMMENDED DOSE

The recommended dose is between 0.5% and 5%.

BIBLIOGRAPHY


Websites:
[consultado en Junio de 2007]

www.fitoterapia.net
http://es.clarins.net/main.cfm?PlanteID=277&lettre=C