Equiseto

Equisetum telmateia

Nome botanico

Equisetum telmateia Ehrh.
sinonimo: *Equisetum maximum* Lam.
(Equisetaceae)

Parti usate

Fusti sterili.

Componenti principali

Sali minerali (principalmente acido silicico epotassio). Flavonoidi. Saponine. Acidiorganici. Fitosteroli. Tannini.

Attività farmacologica

Attività diuretica e remineralizzante.

Impiego clinico

Come diuretico nelle infiammazioni ed infezioni delle vie urinarie, nella urolitiasi ed in condizioni di ritenzione idrica. Come remineralizzante nell'osteoporosi e nelle condizioni di fragilità degli annessi cutanei.

Controindicazioni

Nessuna controindicazione nota.

Avvertenze e speciali precauzioni d'uso

Non sono noti studi clinici controllati in donne in gravidanza e durante allattamento: in conformità con la prassi medica generale, il prodotto non deve essere impiegato senza prima avere sentito il parere del medico.

Interazioni

Nessuna nota.

Effetti indesiderati

Nessuno degno di nota.

Note Bibliografiche

Composizione

L'Equiseto contiene dal 18 al 20% di sali minerali, 2/3 dei quali sono costituiti da acido silicico (per il 10% sotto forma di silicati idrosolubili)[1,2]. Nella pianta vi sono infatti due tipi diversi di silice: quella organo-colloidale o solubile, che forma i colloidi citoplasmatici e risulta legata alle proteine, ai lipidi e agli amidi e quella insolubile o minerale, che si deposita nelle concrezioni epidermiche e all'interno delle membrane cellulari. La silice insolubile è molto resistente agli agenti chimici e, nell'uomo, non svolge alcun ruolo fisiologico perche non viene assorbita. Tra i costituenti minerali spicca inoltre il potassio (3-5%); gli altri minerali presenti sono: calcio (1-2%), magnesio (0.1-0.3%),fosforo (0.4%), azoto (0.6%), zolfo (0.6%), sodio (0.01-0.02%), tracce di zinco e manganese. Sono inoltre abbondantemente presenti flavonoidi, tra i quali isoquercitrina, quercetina, mono- e diglucosidi del kaempferolo (tra cui equisetrina) e della quercetina; saponine (equisetonoside); acidi organici (acido malico, acido ossalico, acido citrico, acido aconitico); tracce di alcaloidi, tra cui nicotina, palustrina e 3-metossipiridina; acidi polienici ed acidi dicarbossilici rari (p.e., acidoequisetolico)[3]; fitosteroli, fra i quali β-sitosterolo (60.0%), campesterolo (32.9%), isofucosterolo (5.9%)[4]; due differenti ferrodossine[5]; tannini, olio essenziale[6].

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1 "**Silicified regions in the stem and leaf of the horsetail Equisetum arvense were studied by scanning and transmission electron microscopy**. The silica was present as a thin layer on the outer surface with variation in the size of this layer depending on the part investigated. There was a dense arrangement of silica spheres with some density fluctuations. A loose arrangement of silica particles with variation in their size was found beneath this dense arrangement suggesting the agglomeration of silica. An electron diffraction pattern showed the presence of amorphous silica, with the short range order being comparable to that of silica from other chemical sources. **The medium range order shows the presence of silica with a high inner surface**. SAXS measurements correlate with the particle size observed in TEM, and provide values for surface fractals. A new method of plasma ashing to remove the organics is also described.." *(Holzhüter G, Narayanan K, Gerber T. Structure of silica in Equisetum arvense. Anal Bioanal Chem. 2003 Jun;376(4):512-7).*

2 *Piekos R, Paslawska S, Grinczelis W. Studies on the optimum conditions of extraction of silicon species from plants with water. III. On the stability of silicon species in extracts from Equisetum arvense herb. Planta Medica 1976; 29: 351-6.*

3 *Franck Bakke IL, Kringstad R, Nordal A. Water-soluble acids from Equisetum arvense L. Acta Pharmaceutica Suecica 1978; 15: 141-7.*

4 "The sterol fraction of Equisetum arvense L. contains, essentially, the following sterols: β-sitosterol (60.0%), campesterol (32.9%), isofucosterol (5.9%) and cholesterol (trace amounts)." *(D'Agostino M, Dini A, Pizza C, Senatore F, Aquino R. Sterols from Equisetum arvense. Bollettino della Società Italiana di Biologia Sperimentale 1984; 60: 2241-5).*

5 "Amino acid sequences of two ferredoxins isolated from *Equisetum arvense* were determined by conventional procedures. Ferredoxins I and II of *Equisetum arvense* had 95 and 93 residues, respectively, and nearly identical sequences each with only one amino acid difference from ferredoxins I and II of E. telmateia (1)… Comparing green plant ferredoxins, it was estimated that this gene duplication occurred about 250 million years ago. Somecomments on the unique amino acid substitutions in horsetail ferredoxins are also presented." *(Hase T, Wada K,Matsubara H. Horsetail (Equisetum arvense) ferredoxins I and II Amino acid sequences and gene duplication.Journal of Biochemistry 1977; 82: 277-86).*

6 "**The volatile constituents of the sterile stems of Equisetum arvense L. (Equisetaceae) were investigated for the first time using GC, GC/MS and (13)C-NMR. Twenty-five compounds were identified. Hexahydrofarnesyl acetone (18.34%), cis-geranyl acetone (13.74%), thymol (12.09%) and trans-phytol (10.06%) were the major constituents**. A disk diffusion method was used for the evaluation of the antimicrobial activity of this oil against a panel of microorganisms (bacteria:

Farmacocinetica

Uno studio di biodisponibilità effettuato nell'uomo ha dimostrato che viene assorbito circa il 36% dell'acido silicico in soluzione ingerito, e che esso viene eliminato completamente dopo circa 48 ore dall'assunzione[7]. L'eliminazione del silicio è prevalentemente renale[8] ed è correlata a quella del calcio e del magnesio, probabilmente sotto forma di ortosilicato[9]. Negli animali ai quali veniva somministrato acido silicico si evidenziava un aumento del collagene nelle cartilagini articolari e un incremento delle concentrazioni plasmatiche di calcio e di magnesio.

Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa and Salmonella enteritidis; fungi: Aspergillus niger and Candida albicans). The 1:10 dilution of the essential oil of Equisetum arvense L. was shown to possess a broad spectrum of a very strong antimicrobial activity against all tested strains." *(Radulović N, Stojanović G, Palić R. Composition and antimicrobial activity of Equisetum arvense L. essential oil. Phytother Res. 2006 Jan;20(1):85-8).*

[7] "Silicon is possibly important in human physiology in protecting against the toxic effects of aluminium, but the kinetics of uptake and excretion of silicic acid, the bioavailable form, are not well characterised. **We have used 32Si as a tracer in a human uptake experiment to determine a gastrointestinal uptake factor for silicic acid, and to elucidate the kinetics of renal elimination**. Urine collections were made for extending intervals from 2 to 12 h over 2 days following ingestion by a single human subject of a neutral silicic acid solution containing tracer levels of 32Si (t1/2 approximately 150 y). Silicon was isolated as SiO2 and the 32Si content determined by accelerator mass spectrometry (AMS), using a gas-filled magnet technique to eliminate a prolific isobaric interference from 32S. Silicon uptake appears to have been essentially complete within 2 h of ingestion. Elimination occurred by two simultaneous first-order processes with half-lives of 2.7 and 11.3 h, representing around 90% and 10%, respectively, of the total output. The rapidly eliminated 32Si was probably retained in the extracellular fluid volume, whilst the slower component may represent intracellular uptake and release. **Elimination of absorbed 32Si was essentially complete after 48 h and was equivalent to 36% of the ingested dose.** This establishes only a lower limit for gastrointestinal absorption as, although there was no evidence for longer term retention of additional 32Si, the possibility could not be excluded by these results." *(Popplewell JF, King SJ, Day JP, Ackrill P, Fifield LK, Cresswell RG, di Tada ML, Liu K. Kinetics of uptake and elimination of silicic acid by a human subject: a novel application of 32Si and accelerator mass spectrometry. J Inorg Biochem. 1998 Feb 15;69(3):177-80).*

[8] "Flavonoids and hydroxycinnamic acids are polyphenolic compounds present in our daily diet in form of tea and vegetables as well as in herbal remedies used in phytomedicine. A wide range of in-vitro activities, in particular their antioxidant properties, have been studied intensively. However, in-vivo-data on absorption, bioavailability and metabolism after oral intake are scarce and contradictory. In order to examine the metabolism and renal excretion of these compounds **a standardized extract from horsetail (Equisetum arvense) was administered to 11 volunteers following a flavonoid-free diet for 8 d**. **24 h urine samples were collected and analyzed by HPLC-DAD.** The putative quercetin metabolites, 3,4-dihydroxyphenylacetic acid or 3,4-dihydroxytoluene could not be detected in urine in any sample. The endogenous amount of homovanillic acid, generally regarded as one of the main quercetin metabolites, was 4+/-1 mg/d and did not increase significantly. However, hippuric acid, the glycine conjugate of benzoic acid, increased twofold after drug intake. Thus, the degradation to benzoic acid derivatives rather than phenylacetic acid derivatives seems to be a predominant route of metabolism. The results of this pilot study give rise to additional, substantial pharmacokinetic investigations in humans." *(Graefe EU, Veit M. Urinary metabolites of flavonoids and hydroxycinnamic acids in humans after application of a crude extract from Equisetum arvense. Phytomedicine. 1999 Oct;6(4):239-46).*

[9] "Silicon (Si), as silicic acid, is suggested to be the natural antidote to aluminium (Al) toxicity, and was recently shown to promote the urinary excretion of Al from body stores. **The metabolism of Si in man**, however, remains poorly investigated. **Here we report on the pharmacokinetics and metabolism of Si in healthy volunteers following ingestion of orthosilicic acid (27-55 mg/l Si) in water**. We also investigated whether orthosilicic acid promotes the urinary excretion of endogenous Al. Minimum, median uptake of Si from the ingested dose was 50.3% (range: 21.9-74.7%, n = 8) based on urinary analysis following dosing. Significant correlations were observed between creatinine clearance and Si levels in serum or urine (r = 0.95 and 0.99, respectively). Renal clearance of Si was 82-96 ml/min suggesting high renal filterability. These results suggest that **orthosilicic acid is readily absorbed from the gastrointestinal tract of man and then readily excreted in urine**. There was no significant increase in Al excretion, over 32 h, following ingestion of the orthosilicic acid dose (P = 0.5; n = 5)." *(Reffitt DM, Jugdaohsingh R, Thompson RP, Powell JJ. Silicic acid: its gastrointestinal uptake and urinary excretion in man and effects on aluminium excretion. J Inorg Biochem. 1999 Aug 30;76(2):141-7).*

Attività biologiche ed impieghi clinici descritti in letteratura

Le attività biologiche e gli impieghi clinici descritti in letteratura per l'Equiseto sono:

Medicina popolare. Nella medicina popolare Italiana l'Equiseto è solitamente usato come diuretico, come emostatico e, analogamente ad altre droghe contenenti silicati, come coadiuvante nel trattamento della tubercolosi. Nella medicina popolare Brasiliana si riconoscono all'Equiseto proprietà diuretiche ed emostatiche; il succo fresco ed il decotto sono prescritti nelle emorragie interne, nelle affezioni dei reni e della vescica e nelle febbri puerperali, mentre all'esterno si impiegano per curare le ferite e le ulcere. Nella medicina tradizionale Europea l'Equiseto è utilizzato come diuretico, emostatico, remineralizzante, ed è prescritto nelle cistiti, nelle coliche nefritiche, nella "renella", nei reumatismi articolari e nella gotta, come epatoprotettore, ecc[10].

Apporto di silicio. I principali impieghi fitoterapici dell'Equiseto si basano sull'apporto di silicio e sulle proprietà biologiche di questo elemento, che è presente in natura sotto forma di ossido di silicio e di acidi silicici corrispondenti[11]. Il corpo umano contiene 8-10 g di silicio, cioè una quantità superiore a quella del ferro. Gli organi più ricchi sono il timo, le ghiandole surrenali, il pancreas, la milza, i polmoni, lo smalto dei denti e le ossa. La pelle e gli annessi cutanei (unghie, capelli, peli) sono noti da molto tempo per il loro elevato contenuto di silicio, al pari di tutti i tessuti di origine ectodermica. La ricerca biologica ha dimostrato che il silicio avrebbe un ruolo guida nel facilitare il deposito del calcio nei siti attivi di calcificazione delle ossa, soprattutto nei primi stadi della loro formazione. Infatti tale elemento interviene insieme a calcio, fosforo, fluoro, magnesio e boro nel processo di calcificazione delle ossa, ma la caduta del suo tasso ematico è più precoce e più spiccata di quella degli altri minerali citati. Osservazioni effettuate al microscopio elettronico hanno evidenziato che il silicio è localizzato soprattutto negli osteoblasti, e quindi può avere un ruolo importante nella loro attività. Si è anche visto che animali alimentati con una dieta particolarmente povera di silicio mostravano una minor formazione di callo osseo dopo una frattura e inoltre il loro osso non era istologicamente normale, mostrando per di più una densità inferiore agli animali di controllo. Gli animali con carenza di silicio avevano un contenuto di acqua nelle ossa significativamente più basso rispetto ai controlli, e ciò potrebbe essere dovuto ad una diminuzione del contenuto di mucopolisaccaridi a livello delle cartilagini articolari. Il silicio potrebbe agire da legame tra le macromolecole di polisaccaridi strutturali quali l'acido ialuronico, il condroitinsolfato, l'eparansolfato ecc., contribuendo in tal modo alla corretta organizzazione di queste sostanze e favorendo quindi la solidità e l'elasticità del connettivo. Queste macromolecole costituiscono anche il legame tra le cellule e la matrice circostante, permettendo alle cellule stesse di monitorare la composizione della matrice e di modificare la propria attività metabolica in rapporto ad essa. Il silicio potrebbe essere indispensabile per l'instaurarsi

[10] *Pedretti M. L'Equiseto: chimica, farmacologia, terapeutica. Erboristeria Domani 1986; Settembre, pag. 39-55.*

[11] *Currie HA, Perry CC. Biomolecular and Materials Interface Research Group, School of Science and Technology, Nottingham Trent University. Silica in plants: biological, biochemical and chemical studies. Ann Bot. 2007 Dec;100(7):1383-9.*

di questi legami, influendo quindi sulla composizione e sul trofismo della cartilagine articolare[12]. Inoltre, sembra che i flavonoidi contenuti nell'Equiseto, in sinergia con l'acido silicico, determinino un aumento del numero degli osteoblasti ed una loro più marcata attività, mentre sarebbero capaci di ridurre sia il numero sia l'attività degli osteoclasti. Ciò potrebbe essere legato, almeno in parte, all'azione dei flavonoidi contro i radicali liberi e i fenomeni flogistici. Tali azioni sono state dimostrate in vitro su colture di tessuto osseo e in vivo in animali da esperimento e anche nell'uomo. Per l'uomo la principale fonte di silicio è rappresentata dall'alimentazione: l'acqua, i legumi, la frutta, i cereali, i tessuti animali sono i cibi più comuni capaci di garantire un apporto adeguato[13,14]. Tuttavia la comune alimentazione può risultare carente di silicio a seguito di molti fattori. Nelle regioni geografiche con terreno calcareo, ad esempio, l'acqua ha una concentrazione di silicio molto bassa; inoltre, il largo uso di cibi raffinati come il pane bianco, i cereali decorticati e la frutta sbucciata determina una minore introduzione di silicio perché questo elemento si trova, in

[12] "There is considerable interest in the effects of silica on human health in contrast to prior research which focused solely on the toxic effects of inhaled crystalline silica. However, **multiple forms of silica exist in nature and silicon, a component, is the second most prevalent element after oxygen**. Silica has widespread industrial applications including use as a food additive, i.e., anti-caking agent, as a means to clarify beverages, control viscosity, as an anti-foaming agent, dough modifier, and as an excipient in drugs and vitamins. **Chemically, silica is an oxide of silicon, viz., silicon dioxide, and is generally colorless to white and insoluble in water. When associated with metals or minerals the family of silicates is formed**. **There are several water soluble forms of silica referred collectively to as silicic acid (ortho, meta, di, and tri-silicates), which are present in surface and well water in the range of 1--100 mg/L. Orthosilicic acid is the form predominantly absorbed by humans and is found in numerous tissues including bone, tendons, aorta, liver and kidney**. Compelling data suggest that silica is essential for health although no RDI has been established. However, deficiency induces deformities in skull and peripheral bones, poorly formed joints, reduced contents of cartilage, collagen, and disruption of mineral balance in the femur and vertebrae. Very little toxicity data exist regarding aqueous silica consumption due, in part, to the lack of anecdotal reports of toxicity and general presumption of safety. However, a few rodent studies have been conducted, which indicate a No Observed Adverse Effects Level (NOAEL) of 50,000 ppm (mg/L) for dietary silica. In conclusion, many forms of silica exist in nature and compelling data support myriad beneficial effects of silica in water." *(Martin KR. POM Wonderful LLC, Los Angeles, CA 91326, USA. The chemistry of silica and its potential health benefits. J Nutr Health Aging. 2007 Mar-Apr;11(2):94-7).*

[13] "Dietary Si (orthosilicic acid; OSA) appears important in connective tissue health, and although the sources and intakes of Si are well established, its absorption is not. **Si absorption was measured from eight high-Si-containing sources: alcohol-free beer; OSA solution (positive control); bananas; green beans; supplemental choline-stabilised OSA (ChOSA); supplemental monomethyl silanetriol (MMST); supplemental colloidal silica (CS); magnesium trisilicate British Pharmacopoeia antacid (MTBP).** Two of the supplements and the antacid were pre-selected following an in vitro dissolution assay. Fasting, healthy subjects (CS, n 3; others, n > or = 5) each ingested two of the sources separated by a 1-week wash-out period. Blood and urine were collected and measured for total Si concentrations by inductively coupled plasma optical emission spectrometry. Absorption, based on urinary Si excretion, was highest for MMST and alcohol-free beer (64% of dose), followed by green beans (44%), OSA (43%), ChOSA (17%), bananas and MTBP (4%) and CS (1%). Peak serum concentrations occurred by 0.5 h for MMST and green beans, 1.5 h for OSA and alcohol-free beer, 2 h for ChOSA and CS, and 4 h for MTBP. Area under the serum curves correlated positively with urinary Si output ($r\ 0.82$; $P < 0.0001$). **Absorption of Si from supplements and antacids was consistent with their known chemical speciation and kinetics of dissolution under simulated gastrointestinal conditions. Monomeric silicates were readily absorbed, while particulate silicates were decreasingly well absorbed with increasing polymerisation**. The present results highlight the need to allow for relative absorption of Si from different foods or supplements in subsequent epidemiological and intervention studies." *(Sripanyakorn S, Jugdaohsingh R, Dissayabutr W, Anderson SH, Thompson RP, Powell JJ. The comparative absorption of silicon from different foods and food supplements. Br J Nutr. 2009 Sep;102(6):825-34).*

[14] *Sripanyakorn S, Jugdaohsingh R, Elliott H, Walker C, Mehta P, Shoukru S, Thompson RP, Powell JJ. The silicon content of beer and its bioavailability in healthy volunteers. Br J Nutr. 2004 Mar;91(3):403-9.*

prevalenza, nelle parti esterne dei vegetali; i tessuti interni ne sono molto più poveri. Una carenza di silicio può contribuire alla rarefazione della trama ossea; negli stati di demineralizzazione ossea la perdita di silicio è proporzionalmente più significativa di quella che si verifica per altri minerali come il calcio e il fosforo. Inoltre, la presenza del silicio è fondamentale per un normale trofismo del tessuto connettivo e, in particolare, della parete arteriosa e venosa. È dimostrato infatti che una carenza di silicio provoca una maggiore permeabilità dell'intima alle molecole lipidiche del plasma, che possono attraversarla e depositarvisi, innescando la formazione dell'ateroma. È possibile quindi che una carenza di silicio possa anche contribuire al progredire della malattia aterosclerotica[15].

Attività diuretica. L'Equiseto "è indicato come diuretico nelle infiammazioni della pelvi renale e batteriurie, in quanto aumenta l'irrigazione delle vie urinarie escretrici. La droga determina una tipica diuresi d'acqua, senza modificazioni dell'equilibrio degli elettroliti (Wichtl,1993; pag. 188-190)". "L'azione diuretica" – che è stata confermata più recentemente anche per altre specie del genere Equisetum[16] – "viene attribuita da alcuni AA. all'acido silicico contenuto nella droga, ciò che venne però messo in dubbio da altri AA., fra i quali… [il] Kreitmair… [il quale ritiene] che responsabile dell'azione diuretica dell'Equiseto, sia una sostanza organica. Per quanto riguarda la natura della sostanza organica cui si riferisce il Kreitmair, si potrebbe formulare l'ipotesi che essa sia rappresentata dalla equisetonina, saponina contenuta nell'Equiseto."Benigni, 1963; pag. 333-338). L'Equiseto ha mostrato azione diuretica[17], ed effetti di stimolazione della funzionalità renale sono stati osservati anche per altri generi di *Equisetum*, quali l'*Equisetum fluviale*, l'*Equisetum hiemale* var. affine, l'*Equisetum giganteum* e l'*Equisetum myriochaetum*, per alcuni dei quali è stata osservata una attività comparabile alla idroclorotiazide[18]. Inoltre, al contrario di quanto affermato

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15 *Pedretti M. L'Equiseto. Chimica, farmacologia, terapeutica. In: Erboristeria Domani, 1986, pag 39-55.*

16 *Lemus I, Garcia R, Erazo S, Pena R, Parada M, Fuenzalida M. Diuretic activity of an Equisetum bogotense tea (Platero herb): evaluation in healthy volunteers. Journal of Ethnopharmacology 1996; 54: 55-8.*

17 "The paper aimed to determine the effects of mixtures of selected medicinal plants on some physiological renal functions, i.e. excretion of urine and electrolytes and changes in the quantity of prostaglandins E2 (PGE_2) and kallikrein-kinins in rat blood plasma after water and salt load. (…) **Herbal drugs were used to compose 6 mixtures. Extracts from these mixtures were administered to Wistar strain males and their effects were compared with the effects of an administered suspension of hydrochlorothiazide, an extract from field horsetail herb alone, and a control group of animals which was not administered any preparation.** The greatest diuretic effect was found in a mixture composed of birch leaves (Betulae folium), hawthorn berries (Crataegi fructus), strawberry leaves (Fragariae folium), corn silk (Maydis stigmata), chamomile flowers (Matricariae flos), and horsetail herb (Equiseti herba). Its effect was greater by 47% and 34% than the effect of a horsetail herb extract and a hydrochlorothiazide suspension ($p < 0.05$), respectively. The extract from this mixture also increased the quantity of prostaglandins E2 and kallikrein-kinins in rat blood plasma in water and salt load." *(Masteiková R, Klimas R, Samura BB, Savickas A, Samura BA, Belaij SI, Samura IB, Rabisková M, Chalupová Z, Bernatoniene J. An orientational examination of the effects of extracts from mixtures of herbal drugs on selected renal functions. Ceska Slov Farm. 2007 Apr;56(2):85-9).*

18 "Chloroform extracts of *Equisetum fluviatile*, *Equisetum hiemale* var. affine, *Equisetum giganteum* and *Equisetum myriochaetum* were studied to determine diuretic activity in CD1 strain mice using hydrochlorothiazide, spironolactone and furosemide as standard drugs for comparison. It was found that **the most active plant was *Equisetum hiemale* var.affine, followed by *Equisetum fluviatile, Equisetum giganteum and Equisetum myriochaetum*, producing an effect similar to that of hydrochlorothiazide** in relation to the excretion of sodium, potassium and chloride." *(Perez Gutierrez RM, Laguna GY, Walkowski*

dal Wichtl, altri AA. hanno osservato anche una iponatriemia ed una ipopotassiemia a seguito di somministrazione ripetuta di *Equisetum telmateia*[19]. Alcuni AA. spagnoli hanno condotto uno screening per valutare il potenziale terapeutico dell'Equiseto e di altri fitocomplessi – *Verbena officinalis*, *Lithospermum officinale*, *Taraxacum officinale*, *Arctostaphylos uva-ursi*, *Arctium lappa* e *Silene saxifraga* – nel trattamento dell'urolitiasi. Il monitoraggio dei principali fattori di rischio di urolitiasi (calciuria, citraturia, fosfaturia, pH urinario e diuresi) ha mostrato un benefico effetto di molti dei fitocomplessi, che può essere riferito sia ad una blanda azione disinfettante, sia all'azione delle saponine. Sebbene siano disponibili farmaci relativamente sicuri per il trattamento delle urolitiasi, il concomitante uso di un fitocomplesso può essere preso in considerazione per facilitare l'azione del farmaco o per migliorare la compliance del paziente[20].

Interazioni con il colesterolo dietetico. È stata descritta una curiosa interazione fra Equiseto e dieta ricca di colesterolo. In ratti alimentati con dieta ipercolesterolemica, l'aggiunta di Equiseto alla concentrazione dello 0,4% e 4% w/w ha determinato la comparsa di una dermatite irritativa del collo e del tronco nel 20-65% degli animali. La dermatite era reversibile se si ritornava alla dieta normale. Gli AA. non traggono conclusioni sul tipo di interazione fra colesterolo dietetico ed Equiseto, ma ciò nonostante sconsigliano l'assunzione del fitocomplesso nelle persone con dieta ricca di colesterolo[21].

Altre attività. È stata descritta un'attività antidiabetica in modelli animali per l'estratto metanolico di Equiseto[22]. Vi sono inoltre diversi studi che dimostrano una significativa attività antiossidante

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A. Diuretic activity of Mexican equisetum. Journal of Ethnopharmacology 1985; 14:269-72).

[19] *Severe hyponatremia and hypopotassemia induced by the consumption of Equisetum telmateia. Miro O, Pedrol E, Nogue S, Cardellach F. Medicina Clinica 1996; 106: 639.*

[20] "The effects of seven plants with suspected application to prevent and treat stone kidney formation (*Verbenaofficinalis, Lithospermum officinale, Taraxacum officinale, Equisetum arvense, Arctostaphylos uva-ursi, Arctium lappa* and *Silene saxifraga*) have been studied using female Wistar rats. Variations of the main urolithiasis risk factors (citraturia, calciuria, phosphaturia, pH and diuresis) have been evaluated. It can be concluded that **beneficial effects caused by these herb infusions on urolithiasis can be attributed to some disinfectant action, and tentatively to the presence of saponins.** Specifically, some solvent action can be postulated with respect to uric stones or heterogeneous uric nucleus, due to the basifying capacity of some herb infusions. Nevertheless, for all the mentioned beneficial effects, more effective and equally innocuous substances are well known." *(Grases F, Melero G, Costa-Bauza A, Prieto R, March J G. Urolithiasis and phytotherapy. International Urology and Nephrology 1994; 26: 507-11).*

[21] "The effects of dietary field horsetail (Equisetum arvense L.) powder on lipid components were studied in rats fed a 20% casein diet with or without cholesterol (0.5% cholesterol and 0.15% sodium cholate) for 14 days. The ingestion of 0.4% or 4% Equisetum arvense L. powder did not influence food intake or growth. However, **a cholesterol diet with Equisetum arvense L. at 4% caused dermatitis at the neck, head and back in about20-65% of the rats. This dermatitis was reversed when the diet was changed to commercial pellets.** There were no apparent effects on serum or liver lipids in the rats fed Equisetum arvense L. irrespective of dietary cholesterol… These results suggest that the ingestion of large amounts of Equisetum arvense L. as cooking material is not recommended for those with a cholesterol-rich diet." *(Maeda H, Miyamoto K, Sano T. Occurrence of dermatitis in rats fed a cholesterol diet containing field horsetail (Equisetum arvense L.). Journal of Nutritional Science and Vitaminology 1997; 43: 553-63).*

[22] "In view of alleged, **the methanolic extract of Equisetum arvense was analysed for its antidiabetic activity in streptozotocin-induced diabetic rats**. The blood glucose lowering activity of the methanolic extract was determined in

sia per l'estratto totale di *Equisetum telmateia*[23,24] e di altre specie di Equiseto[25], sia per alcuni dei singoli componenti del fitocomplesso della droga tra cui l'isoquercetina[26].

Tollerabilità. La letteratura non segnala effetti secondari né tossici[27] alle dosi terapeutiche, a

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streptozotocin-induced (50 mg kg(-1), i.p.; dissolved in normal saline) diabetic rats, after oral administration in doses of 50 and 250 mg kg(-1) daily for 5 weeks. The data was compare statistically using one-way ANOVA tukey test. **The results showed methanolic extract of Equisetum arvense produced a significant antidiabetic activity at doses 50 and 50 mg kg(-1)/b.wt**. Concurrent histological studies of the pancreas of these animals showed comparable regeneration by methanolic extract which were earlier, necrosed by streptozotocin." *(Soleimani S, Azarbaizani FF, Nejati V. The effect of Equisetum arvense L. (Equisetaceae) in histological changes of pancreatic beta-cells in streptozotocin-induced diabetic in rats. Pak J Biol Sci. 2007 Dec 1;10(23):4236-40).*

[23] "**The Hepatoprotective activity-guided fractionation of the MeOH extract of Equisetum arvense L. (Equisetaceae) resulted in the isolation of two phenolic petrosins, onitin (1) and onitin-9-O-glucoside (2), along with four flavonoids, apigenin (3), luteolin (4), kaempferol-3-O-glucoside (5), and quercetin-3-O-glucoside (6**). Among these, compounds 1 and 4 exhibited hepatoprotective activities on tacrine-induced cytotoxicity in human liver-derived Hep G2 cells, displaying EC(50) values of 85.8 +/ -9.3 microM and 20.2 +/- 1.4 microM, respectively. Silybin, used as a positive control, showed the EC(50) value of 69.0 +/- 3.3 microM. Compounds 1 and 4 also showed superoxide scavenging effects (IC(50) = 35.3 +/- 0.2 microM and 5.9 +/- 0.3 microM, respectively) and DPPH free radical scavenging effect (IC(50) of 35.8 +/- 0.4 microM and 22.7 +/- 2.8 microM, respectively). **These results support the use of this plant for the treatment of hepatitis in oriental traditional medicine**." *(Oh H, Kim DH, Cho JH, Kim YC. Hepatoprotective and free radical scavenging activities of phenolic petrosins and flavonoids isolated from Equisetum arvense. J Ethnopharmacol. 2004 Dec;95(2-3):421-4).*

[24] *Cetojević-Simin DD, Canadanović-Brunet JM, Bogdanović GM, Djilas SM, Cetković GS, Tumbas VT, Stojiljković BT. Antioxidative and antiproliferative activities of different horsetail (Equisetum arvense L.) extracts. J Med Food. 2010 Apr;13(2):452-459.*

[25] "The antioxidant and scavenging activities of above ground parts of Equisetum arvense L., Equisetum ramosissimum L. and Equisetum telmateia L. phosphate buffer (pH 7) extracts were investigated. Activities of antioxidant enzymes (superoxide dismutase, catalase, guaiacol peroxidase and glutathione peroxidase), quantities of reduced glutathione, malonyldialdehyde, superoxide and hydroxyl radicals and flavonoid, soluble protein, chlorophyll a, b and carotenoid contents were determined. The total antioxidant capacity was determined by ferric reducing antioxidant power (FRAP) assay. **The Equisetum telmateia extract demonstrated scavenging and antioxidant properties better than Equisetum ramosissimum and Equisetum arvense**. The ESR signal of DMPO-OH radical adducts in the presence of Equisetum telmateia phosphate buffer (pH 7) extract was reduced by 98.9% indicating that Equisetum telmateia could be a useful source of antioxidants with huge scavenging ability." *(Stajner D, Popović BM, Canadanović-Brunet J, Anackov G. Exploring Equisetum arvense L., Equisetum ramosissimum L. and Equisetum telmateia L. as sources of natural antioxidants. Phytother Res. 2009 Apr;23(4):546-50).*

[26] "In this paper, the study of antioxidant activity and phenolic composition of three different extracts (EtOAc, n-BuOH and H(2)O) of field horsetail (Equisetum arvense L.) is presented. The antioxidant activity has been evaluated measuring the total reducing power (expressed by Ascorbate Equivalent Antioxidant Capacity - AEAC), inhibition of lipid peroxidation, and **free radical scavenging capacity (RSC)** towards 2,2-diphenyl-1-picrylhydrazyl (DPPH radical) and nitric oxide (NO), respectively. In addition, the total flavonoid content (TFC) and phenolic constituents of each extract have been determined. **The results obtained show that the highest RSC regarding both DPPH and NO radicals is expressed by EtOAc extract (EC(50)=2.37 microg/mL and EC(50)=90.07 microg/mL, respectively), and the lowest by H(2)O extract (EC(50)=37.2 microg/mL and EC(50)>333.33 microg/mL, respectively)**. n-BuOH extract showed the highest total reducing power (AEAC=13.40 microg/mL). Differences in the phenolic composition of examined extracts are found comparing the HPLC chemical profiles. Although, **isoquercitrin is the main flavonoid in both EtOAc and n-BuOH extracts**, **a considerable amount of di-E-caffeoyl-meso-tartaric acid was presented in the n-BuOH extract**. In H(2)O extract high content of phenolic acids and low percentage of flavonoids were detected." *(Mimica-Dukic N, Simin N, Cvejic J, Jovin E, Orcic D, Bozin B. Phenolic compounds in field horsetail (Equisetum arvense L.) as natural antioxidants. Molecules. 2008 Jul 17;13(7):1455-64).*

[27] "To evaluate the acute hepatotoxicity of Equisentum arvense L. in rats, fifty Wistar rats were used, these being divided in four groups, one being the control (receiving only water) and the other groups receiving graded doses of Equisentum arvense L. (30, 50, and 100mg/kg respectively) for 14 days. Blood samples were obtained to determine TGO, TGP, FA, DHL and GT-gamma activities. After that, hepatic tissue samples were collected for the anatomopathologic analysis. Results: The anatomopathologic

meno che non sia presente una ipersensibilità individuale. Come per tutte le piante ad azione diuretica utilizzate per i disturbi delle vie urinarie (infezioni, calcolosi, renella) generalmente come infusi, forma che consente la contemporanea assunzione di elevate quantità di acqua, è tuttavia opportuno ricordare che la "terapia diluente" è controindicata nei pazienti con edema per insufficienza renale o cardiaca.

exam of the hepatic tissue showed organ with preserved lobular structure. In the same way, there was no significant change in the seric activities of the hepatic enzymes when compared to control group. Conclusion: The oral treatment with graded doses of Equisentum arvense L. was not able to produce hepatic changes. Further studies are necessary to evaluate the chronic hepatotoxicity of Equisentum arvense L. in rats." *(Baracho NC, Vicente BB, Arruda GD, Sanches BC, Brito J. Study of acute hepatotoxicity of Equisetum arvense L. in rats. Acta Cir Bras. 2009 Nov-Dec;24(6):449-53).*