Plantain

Species (Family)

Plantago major L. (Plantaginaceae)

Synonym(s)

Common Plantain, General Plantain, Greater Plantain

Part(s) Used

Leaf

Pharmacopoeial and Other Monographs

BHP 1996[G9]
Complete German Commission E[G3]
Martindale 32nd edition[G43]
PDR for Herbal Medicines 2nd edition[G36]

Legal Category (Licensed Products)

Plantain is not included in the GSL.[G37]

Constituents[G2,G22,G40,G51,G62,G64]

Acids Benzoic acid, caffeic acid, chlorogenic acid, cinnamic acid, *p*-coumaric acid, ferulic acid, fumaric acid, gentisic acid, *p*-hydroxybenzoic acid, neochlorogenic acid, salicylic acid, syringic acid, ursolic acid, vanillic acid;[1,2] oleanolic acid and ascorbic acid.

Alkaloids Trace (unspecified),[3,4] boschniakine and the methyl ester of boschniakinic acid[5]

Amino acids DL-α-Alanine, asparagine, L-histidine, DL-lysine, DL-leucine, serine and tryptophan.[6]

Carbohydrates L-Fructose, D-glucose, planteose, saccharose, stachyose, *d*-xylose, sorbitol, tyrosol, mucilage and gum.[7]

Flavonoids Apigenin, baicalein, scutellarein, baicalin, homoplantaginin, nepitrin, luteolin, hispidulin and plantagoside.[8–10]

Iridoids Aucubin, aucubin derivatives, plantarenaloside, aucuboside and melitoside.[5,11,12]

Tannins 4%. Unspecified.

Other constituents Choline, allantoin, invertin and emulsin (enzymes), fat 10–20%, resin, saponins, steroids[13] and thioglucoside.

Food Use

Plantain leaf is not used in foods. A related species, *Plantago lanceolata* L., is listed by the Council of Europe as a natural source of food flavouring (category N2). This category indicates that *P. lanceolata* can be added to foodstuffs in small quantities, with a possible limitation of an active constituent (as yet unspecified) in the final product.[G16] In the USA, plantain is listed by the Food and Drugs Administration (FDA) as a Herb of Undefined Safety.[G22]

Herbal Use

Plantain is stated to possess diuretic and antihaemorrhagic properties. Traditionally, it has been used for cystitis with haematuria, and specifically for haemorrhoids with bleeding and irritation.[G2,G7,G42,G64]

Dosage

Dried leaf 2–4 g or by infusion three times daily.[G7]

Liquid extract 2–4 mL (1 : 1 in 25% alcohol) three times daily.[G7]

Tincture 2–4 mL (1 : 5 in 45% alcohol) three times daily.[G7]

Pharmacological Actions

In vitro and animal studies

An aqueous extract has been reported to possess bronchodilatory activity in guinea-pigs. It was more effective against acetylcholine-induced contraction, than towards constriction induced by histamine or serotonin.[14] The bronchodilatory activity of plantain in guinea-pigs has been reported to be less active and of shorter duration compared to salbutamol or atropine.[15]

Hypotensive activity in normotensive, anaesthetised dogs has been documented; 125 mg/kg extract

was found to decrease arterial blood pressure by 20–40 mmHg.[16]

An aqueous extract, reported to contain flavonoids, saponins, steroids and alkaloids, was shown to possess anti-inflammatory activity in the rat using various models of inflammation, and a strengthening of capillary vessels has also been documented.[13] However, an extract was found to exhibit minimal (11%) inhibition of carrageenan-induced rat paw oedema.[17] Leaf extracts in hexane have shown potent wound-healing activity in rabbits; the effect was primarily attributed to C_{26}–C_{30} alcohols present in the extract.[18] Both the anti-inflammatory and wound-healing activities of plantain have been attributed to the high content of chlorogenic and neochlorogenic acids.[2]

Aucubin and a haemolytic saponin fraction have exhibited antibiotic activity towards *Micrococcus flavus* and *Staphylococcus aureus* (aucubin only).[19] Antibacterial activity towards *Bacillus subtilis* has been documented for the fresh plant juice, which was also found to lack activity towards Gram-positive organisms and fungi.[20] A negative response to cytotoxic, antitumour and antiviral activity was also reported for the plant juice.[20]

A mild laxative action has been reported in mice administered iridoid glycosides, including aucubin.[21] Plantain seed is sometimes used as a substitute for ispaghula (a bulk laxative).[G45]

Plantain has been documented to lower concentrations of total plasma lipids, cholesterol, β-lipoproteins and triglycerides in rabbits with experimental atherosclerosis.[22] Plantain has been reported to be useful in lowering plasma cholesterol concentrations.[23]

A tonus-raising effect on isolated guinea-pig and rabbit uterus tissue has been documented for an aqueous extract at a dose of 1–2 mg/cm^3.[24]

Aucubin has been stated to be the active principle responsible for a hepatoprotective effect documented for plantain.[25]

Clinical studies

Plantain has been reported to be effective in the treatment of chronic bronchitis of a spastic or non-spastic nature.[14,26,27] A pronounced improvement in both subjective and objective symptoms of the common cold following treatment with plantain has also been reported.[28] Plantain, in combination with agrimony, German chamomile, peppermint and St. John's wort, has been documented to provide pain relief in patients with chronic gastroduodenitis.[29] Following treatment, previously diagnosed erosions and haemorrhagic mucous changes were stated to have disappeared.

Side-effects, Toxicity

Allergic contact dermatitis to plantain has been reported.[G51] The green parts of the plant are thought to yield a mustard oil-type of thioglucoside, which releases an irritant principle (isothiocyanate) upon enzymatic hydrolysis.[G51] The seed may also cause sensitisation and dermatitis. Plantain is reported to be of low toxicity with LD_{50} values in the rat documented as 1 g/kg (intraperitoneal injection) and greater than 4 g/kg (by mouth).[15]

Contra-indications, Warnings

Plantain may cause a contact allergic reaction; it induces the formation of IgE antibodies, which may cross-react to psyllium.[30] Excessive doses may exert a laxative effect and a hypotensive effect.

Pregnancy and lactation *In vitro* uterotonic activity has been documented for plantain. In view of this, excessive use of plantain, which may also exert a laxative effect, should be avoided during pregnancy.

Pharmaceutical Comment

The constituents of plantain are well documented and the reputed antihaemorrhagic properties are probably attributable to the tannin constituents. In addition, bronchospastic activity has been documented in both animal and human studies, and may warrant further research. The toxicity of plantain is reported to be low but excessive ingestion should be avoided. The bulk laxative ispaghula consists of the dried seeds of related species *Plantago psyllium*, *P. ovata* and *P. indica*.[G45]

References

See also General References G2, G3, G9, G16, G22, G31, G36, G37, G40, G42, G43, G51, G62 and G64.

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