Java Tea

Species (Family)

Orthosiphon stamineus Benth. (Lamiaceae)

Synonym(s)

Kumis Kucing (Indonesian, Malay), *Orthosiphon aristatus* Miq., *Orthosiphon spicatus* (Thundb.) Bak.

Part(s) Used

Fragmented dried leaves, tops of stems

Pharmacopoeial and Other Monographs

BHP 1996[G9]
BP 2001[G15]
Complete German Commission E[G3]
ESCOP 1997[G52]
Martindale 32nd edition[G43]
PDR for Herbal Medicines 2nd edition[G36]
Ph Eur 2002[G28]

Legal category (Licensed Products)

Java tea is not included in the GSL.

Constituents[G2,G52]

Benzochromenes Orthochromene A,[1] methylripariochromene A[2] and acetovanillochromene.[1]

Diterpenes Isopimarane-type diterpenes (orthosiphonones A and B,[1] orthosiphols A and B,[3] orthosiphols F, G, H and I[4]), pimarane-type diterpenes (neoorthosiphols A and B)[5] and staminol A.[4]

Essential oil 0.02–0.7%. Various compounds including β-elemene, β-caryophyllene, α-humulene, β-caryophyllene oxide, can-2-one and palmitic acid.[6]

Flavonoids Sinensetin, tetramethylscutellarein and other tetramethoxyflavones, eupatorin, salvigenin, cirsimaritin, pilloin, rhamnazin, trimethylapigenin and tetramethylluteolin.[7–11] These lipophilic flavonoids are present in concentrations of approximately 0.2–0.3%;[10] flavonoid glycosides are also present.

Other constituents Caffeic acid and derivatives (e.g. rosmarinic acid), inositol, phytosterols (e.g. β-sitosterol)[11,12] and potassium salts.

Food Use

Java tea is not used in foods.

Herbal Use[G35]

Java tea has traditionally been used in Java for the treatment of hypertension and diabetes.[1,5,13] It has also been used in folk medicine for bladder and kidney disorders, gallstones, gout and rheumatism. Java tea is stated to have diuretic properties.[14]

Dosage

Dried material 2–3 g in 150 mL water two to three times daily as an infusion.[G52]

Pharmacological Actions

In vitro and animal studies

Diuretic effects Several studies in rats have reported diuretic activity of extracts of *O. stamineus* and *O. aristatus*[14–16] and of flavonoids (sinensetin and a tetramethoxyflavone) isolated from *O. aristatus*.[17] Intraperitoneal administration of a hydroalcoholic extract of *O. stamineus* to rats caused a significant diuresis over the following 2–24 hours compared with controls.[14] The effect was similar to that observed following intraperitoneal administration of hydrochlorothiazide (10 mg/kg).[14] Oral administration of an aqueous extract of *O. aristatus* increased ion excretion to a similar extent as did furosemide (frusemide), although no diuretic action was noted.[16]

Oral administration of methylripariochromene A (100 mg/kg) has been shown to increase urinary volume in fasted rats for three hours after oral administration; the increase in urine volume was similar to that observed with oral administration of hydrochlorothiazide (25 mg/kg).[13] Sodium, potassium and chloride ion excretion was increased with methylripariochromene A (100 mg/kg), although urinary sodium ion excretion did not increase. A

mechanism for the diuretic action of methylriparіochromene A has not yet been elucidated, although it appears to have a different mode of action to that of hydrochlorothiazide.[13]

Hypoglycaemic effects In normoglycaemic rats, oral administration of an aqueous extract of *O. stamineus* (0.5 g/kg) had no significant effect on fasting blood glucose concentrations over a 7-hour period, although administration of 1 g/kg produced a significant decrease in blood glucose concentration compared with that in a control group.[18] A hypoglycaemic effect was also observed following administration of *O. stamineus* extract (1 g/kg) to rats loaded with glucose (1.5 g/kg) and in streptozotocin-induced diabetic rats; the effect of *O. stamineus* extract in streptozotocin-induced diabetic rats was similar to that observed with glibenclamide (10 mg/kg).[18]

Antihypertensive effects Methylriparіochromene A has been reported to have several pharmacological actions related to antihypertensive activity.

In stroke-prone, spontaneously hypertensive rats, subcutaneous administration of methylriparіochromene A (100 mg/kg) produced a continuous reduction in systolic blood pressure and a decrease in heart rate. Methylriparіochromene A also suppressed agonist-induced contractions in the rat thoracic aorta and decreased the contractile force in isolated guinea-pig atria without significantly affecting the beating (heart) rate. The mechanism of action for these antihypertensive effects of methylriparіochromene A is, however, unclear.[13]

Migrated pimarane-type diterpenes (neoorthosiphols A and B), isopimarane-type diterpenes (orthosiphols A and B, orthosiphonones A and B), benzochromenes (methylriparіochromene, acetovanillochromene, orthochromene A) and flavones (tetramethylscutellarein, sinensetin) isolated from *O. aristatus* have been reported to exhibit a suppressive effect on contractile responses in the rat thoracic aorta.[19]

Cytostatic effects Sinensetin and tetramethylscutellarein have been reported to demonstrate *in vitro* cytostatic activity towards Ehrlich ascites tumour cells.[10] Growth inhibition appears to be dose dependent, with 50% inhibition occurring at concentrations of approximately 30 and 15 µg/mL for sinensetin and tetramethylscutellarein, respectively. Orthosiphols A and B have been reported to inhibit inflammation induced by the tumour promoter 12-O-tetradecanoylphorbol-13-acetate (TPA) on mouse ears.[3]

Fractions of *O. stamineus* leaves have been reported to have activity against a melanoma cell line *in vitro*.[20]

Antimicrobial effects An aqueous extract of *O. aristatus* has demonstrated antibacterial activity against two serotypes of *Streptococcus mutans* (MIC 7.8–23.4 mg/mL).[21] Other *in vitro* studies have reported a lack of antibacterial activity for flavonoids (sinensetin, tetramethylscutellarein and a tetramethoxyflavone in concentrations of 10 and 100 µg/mL) isolated from *O. aristatus* leaves against *Escherichia coli*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Enterococcus*.[17]

O. stamineus extract has also been shown to inhibit spore germination in six out of nine fungal species tested: *Saccharomyces pastorianus*, *Candida albicans*, *Rhizopus nigricans*, *Penicillium digitatum*, *Fusarium oxysporum* and *Trichophyton mentagrophytes*.[22]

Other effects *In vitro*, *O. spicatus* has been shown to inhibit 15-lipoxygenase, an enzyme thought to be involved in the development of atherosclerosis.[11] Furthermore, the flavonoids sinensetin and tetramethylscutellarein demonstrate dose-dependent inhibition with IC_{50} values of 114 ± 5 and 110 ± 3 µmol/L, respectively, although other flavonoids from *O. spicatus* appear to be less efficient inhibitors of 15-lipoxygenase. The inhibitory activity of the whole extract was greater than could be expected from the activities of each of its flavonoid constituents, and it has been suggested that synergism may be occurring.[11] More recent *in vitro* studies have shown that flavonoids from *O. spicatus* prevent oxidative inactivation of 15-lipoxygenase, with trimethylapigenin, eupatorin and tetramethylluteolin showing the strongest enzyme-stabilising effects.[23] However, there was no correlation between enzyme stabilisation and enzyme inhibition.[23]

Clinical studies

Early studies reported increases in diuresis in subjects following the oral administration of extracts of *Orthosiphon*.[G52] A randomised, double-blind, placebo-controlled, crossover study reported no effect on 12- and 24-hour urine output or on sodium excretion in 40 healthy volunteers who received 600 mL of an infusion of *Orthosiphon* leaves daily (equivalent to 10 g dried leaves) for four days.[24] A study involving six healthy volunteers who drank

Orthosiphon tea (250 mL) every 6 hours for one day reported an increase in urine acidity 6 hours after ingestion.[25]

A study involving 67 patients with uratic diathesis who received Java tea for three months reported that no effects were observed on diuresis, glomerular filtration, osmotic concentration, urinary pH, plasma content and excretion of calcium, inorganic phosphorus and uric acid.[26]

Side-effects, Toxicity

None documented.

Contra-indications, Warnings

None known. In view of the lack of clinical data on the use of Java tea, excessive or long-term use should be avoided. Adequate fluid intake (2 L or more per day) should be ensured whilst using Java tea.[G35]

Pregnancy and lactation There are no data available on the use of Java tea in pregnancy and lactation. In view of the lack of toxicity data, use of Java tea during pregnancy and lactation should be avoided.

Pharmaceutical Comment

The reported pharmacological activities of Java tea are mainly associated with the lipophilic flavonoids, benzochromene and, to a lesser extent, diterpene constituents.

Documented scientific evidence from *in vitro* and animal studies provides some supportive evidence for some of the traditional uses of Java tea. However, there is a lack of clinical data and well-designed, controlled clinical trials involving adequate numbers of patients are required. Furthermore, studies investigating the active principles responsible for specific pharmacological activities and their mechanisms of action are necessary.

There have been reports of adulteration/botanical substitution occurring with *Orthosiphon*.[27,28,G2]

In view of the lack of toxicity and safety data, excessive use of Java tea should be avoided.

References

See also General References G2, G3, G9, G15, G28, G36, G43 and G52.

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