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Medicinal Potentials Of Orthosiphon Stamineus Benth

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Abstract

Orthosiphon stamineus Benth. is a medicinal herb belonging to the family Lamiaceae, grown in Southeast Asia. Leaves of this plant are used commonly in Southeast Asia and European countries for herbal tea, well known as “Java tea”. Traditionally leaves of this plant have been used as diuretic, and to treat rheumatism, abdominal pain, kidney and bladder inflammation, edema and gout. Studies have shown that the *O. stamineus* leaves exhibit a range of pharmacological properties such as, anti-inflammatory, antioxidant, anti-bacterial, antiangiogenetic properties. Above all, the plant has synergistic bio-enhancing ability for tamoxifen against human breast cancer. The herb has been shown to be exceptionally safe with no toxicity *in vitro* and *in vivo*. This review emphasizes the systematic investigation in pharmacological properties of *O. stamineus*, which could be the potent source of novel herbal curative medicine for critical human diseases.

Background

O.stamineus commonly known as Misai kucing and Kumis kucing. O. stamineus is widely grown in Southeast Asian and the tropical countries. Leaves of this plant are used commonly in Southeast Asia and European countries for herbal tea, well known as “Java tea” (Indubala, 2000). The plant has extensively been exploited traditionally to treat several human ailments. Leaves of this plant have been used as diuretic, and to treat rheumatism, abdominal pain, kidney and bladder inflammation, edema, gout and hypertension (Hegnauer, 1966; Wangner, 1982; Eisai, 1995). Usuualy, the leaves and stem tips of the plant were used medicinally. Scientific studies have found that the leaves exhibit dynamic pharmacological properties such as, antioxidant, antibacterial, heptoprotective, anti-inflammatory, cytotoxic, diuretic, antihypertensive and vasodialative properties (Chung et al., 1998; Masuda, et al., 1992; Tezuka et al., 2000; Beaux et al., 1999).

O.stamineus is a herbaceous shrub, belonging to the family Lamiaceae, which grows to a height of 1.5 m. The leaves are arranged in opposite pairs. They are simple, green, and glabrous with a lanceolate leaf blade and a serrate margin. The leaf apice is acuminate with an acute leaf base. The petiole is relatively short, about 0.3 cm in length and reddish purple in color. The stem is quadrangle, reddish in color, erect and with profuse branching. The plant is distributed throughout Southeast Asia and tropical Australia. Although it looks similar to peppermint, the plant has a dry, salty, bitter taste. Chemically speaking, naturally the plant is bestowed with high amount of flavones, polyphenols, bioactive active proteins, glycosides, a volatile oil, and vast quantities of potassium. Earlier studies reported bioactive pentacyclic triterpenes betulinic acid, oleanolic acid, ursolic acid and β-sitosterol from the leaves of this plant (Tezuka et al., 2000). More than twenty phenolic compounds were isolated from this plant including lipophilic flavones, flavonol glycosides and caffeic acid derivatives such as rosmarinic acid and 2,3-dicaffeoyltartaric acid, were identified and quantified by HPLC (Sumaryono et al., 1991). Recently we reported a rapid, quantitative and simultaneous HPLC-based determination of major phytochemicals from the extract of O. stammineus leaves and reconfirmed its strong antioxidant potency and total phenolic content (Akowuah et al., 2004).

The plant’s strong anti-oxidant action is what makes many researchers to explore the potential pharmacological properties of this plant. O. stamineus is listed in the French, Indonesia, Dutch, and Swiss pharmacopoeias for conditions related to renal cleansing and function, and related disorders that include nephritis, cystitis, and urethritis. In Europe, people use the leaves of O. stamineus extract as a tonic for kidney and bladder stones, liver and gallbladder problems and urinary tract infections. It is also used to reduce cholesterol and blood pressure. Researchers have found it to be mildly antiseptic as well.

Other names for O. stamineus include: Orthosiphon aristatus, Orthosiphon spicatus, Orthosiphon blaetter, Java tea, Misai kuching, Kumis kucing, Indischer Nierentee, Feuilles de Barbiflore, and de Java.

Systematic research on O. stamineus had begun since 1970. One of earlier research works (Van deer Veen et al., 1979) reported that, because of the high content of potassium, inositol and lipophilic flavones in the leaves of O. stamineus it possesses strong diuretic

and bacteriostatic activities. Further investigations based on the Gas Chromatography-Mass Spectrometry (GC-MS) studies [Schmidt et al., 1986], showed that the essential oil derived from fresh leaves of O. stamineus is composed of bioactive volatile organic compounds such as b-caryophyllene, belemene, humulene, b-bourbonene, 1-octen-3-ol and caryophyllene oxide.

Phamaco-medicinal Significances

O. stamineus as a remedy for kidney stones and gout

Deposition of precipitates of calcium oxalate crystals lead to the condition commonly known as kidney stones, which can be easily diagnosed by radiological studies or ultrasound examination. This kind of crystal is difficult to be dissolved and expelled successfully out from the body with clinical therapy, however certain medications proved to be act as prophylactic agents in preventing the calcium stones if they have a propensity to recur. Kidney stones can also be caused by abnormality in uric acid metabolism. Uric acid is a common component of urinary and renal calculi (kidney stones). Diuretic action is the prerequisite quality which has to be possessed by the medicine use as a curative for kidney stones of this type. An increase in the volume of fluid flowing through the kidney will help in dissolution of the stones, assisting their flushing out from the body without further retention, and deposits. Several studies provide a scientific evidence for the traditional use of O. stamineus in the treatment of kidney stones and gout. O. stamineus appears to enhance the activity of adenosine A receptor antagonists, and in turn stimulate the kidney for excessive flow of urine and thus sodium and other ions excretion. Similarly, another study reported that O. stamineus reduces levels of uric acid in rodents (Arafat et al., 2008).

O. stamineus as a remedy as antipyretic

A recent study reported another remarkable property of O. stamineus. Researchers chemically induced body temperature in experimental rodents then treated them O. stamineus. The extract significantly lowered the hyperthermia. The effect was observed within 4 h of the treatment. The fever-reducing efficacy of O. stamineus was comparable with that of standard drug acetaminophen (Yam et al., 2009).

O. stamineus as a Anti-inflammatory and Analgesic agent

Several research studies also reported the anti-inflammation and analgesic activity of O. stamineus. Researchers chemically induced edema in the hind paws of rats. Then the animals were administered with the extract of O. stamineus. The extract significantly reduced the edema 3 and 5 h after the swelling was induced. In addition, O. stamineus also exhibited significant pain-killing activity.6 According to the study, the results of the provided supportive evidence about O. stamineushas as anti-inflammatory and non-narcotic analgesic agent. These findings justify the traditional medicinal uses of the plant to cure pain and inflammation.

O. stamineus as antimicrobial and antioxidant

Recently, several researchers (Chun-Hoong et al., 2010; Chen et al., 1989) reported the antimicrobial against Vibrio parahaemolyticus, Streptococcus mutans, and antioxidant activities of O. stamineus. Several different extracts of the O. stamineus were tested for antimicrobial and antioxidant activities against selected food-borne bacteria in vitro. Whole O. stamineus plants (powdered) were extracted using various concentrations (0%, 25%, 50%, 75%, and 100%) of methanol. O. stamineus extracted with 50% methanol, 75% methanol and fraction 5 of a 50% methanolic extract demonstrated inhibitory activity against Vibrio parahaemolyticus.

O. stamineus as a hepatoprotective agent

In one of the preliminary study (Yam, 2007) it is reported that due to the strong anti-oxidant property of O. stamineus it exhibits hepatoprotective effect in rats. Latter, the bilirubin lowering potential of O. stamineus was evaluated by Faizah et al., (2009) in jaundiced rats. Treatment of these rats with aqueous extract of O. stamineus for three days reduced the bilirubin level significantly to the normal value. Whereas smaller dose (50 mg/kg body weight) resulted in the reduction in bilirubin level nearly half when compared to the control. Therefore, O. stamineus aqueous extract can be used to reduce bilirubin concentration to a normal level in jaundiced subjects.

O. stamineus as a hypoglycemic agent

Sriplang et al., (2007) investigated the effects of O. stamineus on plasma glucose concentration and lipid profile in normal and streptozotocin-induced diabetic rats. In oral glucose tolerance test, the extract significantly decreased plasma glucose concentration in a dose-dependent manner in both normal and diabetic rats. The extract at 1.0 g/kg was most effective in decreasing plasma glucose concentrations and the response was closed to the result of glibenclamide (5 mg/kg). After repeated daily oral administrations of the extract for 14 days, the extract significantly reduced plasma glucose concentration in diabetic rats at days 7 and 14. By the end of the study,

plasma triglyceride concentration was lower in the extract-treated diabetic rats than untreated ones. Furthermore, plasma HDL-cholesterol concentration was significantly increased in diabetic rats treated with the extract. In perfused rat pancreas, the extract did not increase insulin secretion in the presence of 5.5 mM glucose, but 100 g/ml extract potentiated glucose-induced insulin secretion. These findings suggested that O. stamineus is effective for alleviating hyperglycemia and improving lipid profile in diabetic rats.

Unlike some pharmaceutical diuretics, which are thought to increase the risk of diabetes by promoting glucose intolerance, O. stamineus can actually maintain blood sugar levels. When the extract was given to normal and diabetic rats, it significantly decreased plasma glucose concentration in a dose-dependent manner. After repeated daily oral administrations of the extract for 14 days, the extract significantly reduced plasma glucose concentration in diabetic rats at days 7 and 14. By the end of the study, plasma triglyceride concentration was lower in the extract-treated diabetic rats than untreated ones. Furthermore, plasma HDL-cholesterol concentration was significantly increased in diabetic rats treated with the extract.8 “Our findings suggested that O. stamineus aqueous extract is effective for alleviating hyperglycemia and improving lipid profile in diabetic rats,” the researchers wrote.

O. stamineus as Synergistic enhancer to tamoxifen

One of our lab findings (Sahib et al., 2009) reported the interesting effect of O. stamineus with tamoxifen towards estrogen dependent human breast cancer. It enhances the cytotoxic efficacy of tamoxifen to about 5 folds against the breast cancer cell line (MCF 7). These findings concluded that, the O. stamineus may probably exert the anti-estogenic effect.

O. stamineus as an anti-angiogenic agent

Our previous study (Sahib et al., 2009) demonstrated that O. stamineus significantly suppressed the sprouting of neovascularization of microvessels from the excised thoracic rat aorta, when cultivated in specialized 3-dimensional media in presence of the extract. Further studies revealed that, the extract has remarkable inhibitory activity on angiogenesis by blocking VEGF signaling pathway.

O. stamineus in general health maintenance

A 2007 study suggests that O. stamineus may be as protective to the liver as it is to the kidney. Researchers treated rats with O. stamineus then induced liver toxicity in the rodents. The botanical dose-dependently reduced the necrotic changes in the liver and inhibited the increase of serum ALT and AST activities. O. stamineus also acted as a powerful antioxidant and free radical scavenger (Yam et al., 2007).

O. stamineus in balancing nitric oxide Levels

Nitric oxide (NO) is an important molecule that signals the blood vessels to relax and acts in many tissues to control a diverse range of physiological functions. When certain cells are activated by specific proinflammatory agents such as endotoxins, tumor necrosis factor (TNF), interferon-gamma (IFNg), and interleukin-1 (IL-1), NO is produced and protects the host by damaging pathogenic DNA. Balanced amounts of nitric oxide are essential to optimal health because just as normal amounts of NO promote health, the excessive production of NO that can occur during the inflammatory process can have detrimental effects on many organ systems of the body, which can lead to tissue damage. Therefore, inhibiting NO accumulation by inflammatory stimuli can result in overall benefits. O. stamineus has been shown to inhibit levels of nitric oxide in macrophages that were stimulated with inflammatory endotoxins, indicating that the botanical can help support healthy levels of nitric oxide and reduce one of the harmful effects of inflammation (Awale et al., 2003).

Safety of O. stamineus

O. stamineus has been extensively studied in rodents with no signs of toxicity. In a 2008 study, researchers administered the botanical orally to rats for 14 days and compared it to a control group receiving distilled water. The four test groups were treated with 0.5 g/kg, 1 g/kg, 3 g/kg and 5 g/kg body weight of O. stamineus respectively. No lethality or adverse toxic signs were seen during the experimental period.9 The study concluded that O. stamineus within these range and treatment duration would not cause any severe toxic effects and organ damage in rats. Individuals in Malaysia, Vietnam and Japan have consumed O. stamineus for centuries, further supporting its safety. Furthermore, recently the herb has been shown to be exceptionally safe with no toxicity in vitro and in vivo (Muhammad et al., 2010; Mohamed, Lim, Ebrika, Asmawi, Sadikun, & Yam, 2010).

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