WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 16, 1189-1206. Review Article ISSN 2277–7105

A REVIEW ON PHYTOCHEMISTRY AND THERAPEUTIC EFFECTS OF CAT'S WHISKER PLANTS*(ORTHOSIPHON STAMINEUS)*

Kaviya S.*[1], Mr. S. Prakash[2], Dr. M. Ranjith[3], Gayathiri S.[1] and Umashankari E.[1]

[1]Student, SS Institute of Pharmacy, Sankari, Salem-637301.

[2]Assistant Professor, Department of Pharmaceutical Regulatory Affairs.

[3]Assistant Professor, Doctor of Pharmacy.

Article Received on
02 July 2025,

Revised on 22 July 2025,
Accepted on 12 August 2025

DOI: 10.20959/wjpr202516-37961

***Corresponding Author**
Kaviya S.
Student, SS Institute of Pharmacy, Sankari, Salem-637301.

ABSTRACT

Orthosiphon *stamineus Benth*., widely known as Cat's Whiskers or Java Tea, is a traditional Southeast Asian medicinal herb belonging to the Lamiaceae family. Traditionally consumed as herbal infusions or decoctions, *O. stamineus* has long been used to treat a wide range of ailments, including kidney and urinary disorders, hypertension, hyperglycemia, arthritis, hepatic dysfunction, and hyperlipidemia. Its therapeutic efficacy is attributed to a rich spectrum of bioactive phytochemicals, including flavonoids (sinensetin, eupatorin, quercetin), phenolic acids (rosmarinic acid, caffeic acid), diterpenoids (orthosiphols), saponins, and essential oils (camphor, limonene, β-caryophyllene). These compounds contribute to various pharmacological activities, including antioxidant, anti-inflammatory, antihypertensive, antidiabetic, nephroprotective, hepatoprotective, and cytotoxic effects. Preclinical studies have demonstrated mechanisms of action such as inhibition of NF-κB and STAT1, activation of Nrf2 signaling, ACE inhibition, and modulation of glucose metabolism. Furthermore, traditional preparation methods such as decoction and infusion remain central to its ethnomedicinal use. Toxicological evaluations indicate that *O. stamineus* extracts are largely safe, with no significant genotoxic effects. This review highlights the ethnobotanical background, phytochemical diversity, pharmacological actions, traditional uses, and safety profile of *O. stamineus*, while emphasizing current research gaps and future directions for its integration into modern phytotherapeutics.

KEYWORDS: *Orthosiphon stamineus*, Java Tea, Cat's Whiskers, Phytochemicals, Therapeutic Effect, Clinical studies, Toxicological studies.

INTRODUCTION

Medicinal plants have long served as an invaluable source of bioactive compounds for therapeutic use, offering culturally rooted remedies and promising leads for drug discovery. Among these, *Orthosiphon stamineus Benth.*, commonly referred to as Cat's Whiskers or Java Tea, has gained considerable scientific and ethnomedicinal attention due to its diverse pharmacological potential. Belonging to the family *Lamiaceae, O. stamineus* is a perennial herb indigenous to tropical regions of Southeast Asia, notably Malaysia, Indonesia, and Thailand. Traditionally, its aerial parts—especially the leaves—are prepared as infusions or decoctions and consumed as "Java tea," widely used in folk medicine for the management of a variety of health conditions, including kidney and urinary tract disorders, hypertension, hyperglycemia, inflammation, and hepatic dysfunction.[1]

The therapeutic efficacy of *O. stamineus* is largely attributed to its rich and diverse phytochemical profile. Phytochemical analyses have identified a broad range of secondary metabolites, including over 20 phenolic compounds such as rosmarinic acid and 2,3-dicaffeoyltartaric acid; polymethoxylated flavones including sinensetin, eupatorin, and tetramethoxyflavones; as well as diterpenoids (notably orthosiphols), triterpenes, monoterpenes, and essential oils such as camphor and limonene. These constituents contribute to the plant's multifaceted pharmacological activities, which encompass antioxidant, anti-inflammatory, antimicrobial, antihypertensive, antidiabetic, hepatoprotective, nephroprotective, gastroprotective, cytotoxic, and cardioprotective effects.

Recent scientific investigations—spanning in vitro experiments, in vivo animal models, molecular docking studies, and emerging metabolomic approaches—have begun to elucidate the molecular mechanisms that underpin these therapeutic properties. For example, rosmarinic acid has been shown to activate the Nrf2 signaling pathway, enhancing cellular antioxidant defenses, while poly-methoxylated flavones like sinensetin and eupatorin exhibit anti-inflammatory activity by inhibiting the NF-κB and STAT1 pathways. Moreover, the plant's ability to modulate key enzymes such as angiotensin-converting enzyme (ACE) and α-glucosidase suggests its value in managing hypertension and type 2 diabetes, respectively. Additionally, increased nitric oxide production and improved endothelial function have been associated with its cardioprotective effects.

Despite these promising findings, challenges persist in translating the traditional uses and preclinical evidence into standardized therapeutic products. Key issues include the lack of uniform extraction methods, variability in phytochemical content across geographical locations and cultivation conditions, limited clinical trials, and insufficient toxicological assessments. There is also a need for pharmacokinetic profiling and quality control measures to ensure consistency and safety in formulation development.

In light of the growing global interest in plant-based medicine and the substantial body of literature now available, this review aims to comprehensively compile and critically analyze the phytochemical constituents and pharmacological effects of *Orthosiphon stamineus*. By integrating data from ethnobotanical sources, phytochemical studies, pharmacological investigations, and emerging clinical insights, this article seeks to highlight the therapeutic promise of *O. stamineus*, identify current knowledge gaps, and provide strategic directions for future research, clinical evaluation, and potential pharmaceutical development.[2,3]

Scientific classification

Kindom:	Plantae
Clade:	Trachephytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Asterids
Order:	Lamiales
Family:	*Lamiaceae*
Genus:	Orthosiphon

Binomial name
Orthosiphon stamineus (Benth) Miq.
Synonym
Ocimum aristatum Blume
Orthrosiphon aristatus
Clerodendrum spiratum Thunb
Ocimum grandiflorum Blume 1826 not Lam. 1785
Orthosiphon spiralis (Lour.)Merr.
Clerodendranthus stamineus (Benth.) Kudo
Orthosiphon velteri Doan
Orthosiphon spicatus (Thunb.) Backer, Bakh.f.& Steenis 1950 not Benth.1848
Orthosiphon tagawae Murata
Clerodendranthus spicatus (Thunb.) C.Y.Wu
Trichostema spirale Lour., rejected name,[4].

Geographical Ethnobotanical

Orthosiphon stamineus, commonly known as Cat's Whiskers or Java Tea, is a well-known ethnomedicinal plant with widespread geographical usage across tropical and subtropical regions. Its origin is believed to be in Southeast Asia, particularly in Malaysia and Indonesia, where it is traditionally cultivated and highly valued in folk medicine. The plant thrives in humid, low-altitude environments and is adapted to a wide range of tropical ecosystems. In Malaysia, it is deeply integrated into Malay traditional medicine for its diuretic, anti-inflammatory, and anti-hypertensive properties. In Indonesia, it forms a staple part of Jamu, a traditional herbal medicine system. In Thailand and Vietnam, it is used as a detoxifying herbal tea and is commonly prescribed in traditional pharmacopoeias. Due to its growing popularity and recognized efficacy, the plant has been introduced into India, China, and parts of Africa, where it is now part of traditional healing systems such as Ayurveda, Siddha, and Traditional Chinese Medicine (TCM). In Africa, particularly Tanzania and Nigeria, it is locally adapted and used for managing diabetes, urinary tract infections, and liver problems. Its spread to Europe and Australia is largely driven by demand for herbal diuretic teas and natural remedies, under the name Java Tea. This widespread use across diverse cultures and ecosystems underlines its ethnobotanical importance and potential for global phytopharmaceutical development.[5,6]

Ethnobotanical Significance by Region

Region	**Local Name**	**Uses in Traditional Medicine**
Malaysia	Misai Kucing	Diuretic, anti-hypertensive, and kidney stone treatment
Indonesia	Kumis kucing	Diabetes, gout, rheumatism, urinary disorder
Thailand	Yaa Nuat Maeo	Diuretic, blood pressure management
Vietnam	Rau meo	Detoxifying tea, kidney cleanser

China	Mao Xu Cao	Kidney disorder
India	Cat's Whiskers	Used in Siddha and Ayurveda for blood purification, diabetes
Africa	N\A	Herbal tea for diabetes and inflammation

Pharmacological Activity

Cat's whisker leaves in Indonesia have been widely used for diuretics, preventingand treating rheumatism, diabetes mellitus, hypertension, tonsillitis, epilepsy, menstrual disorders, gonorrhea, syphilis, kidney stones, gallstones, acute and chronic nephritis, gouty arthritis, and antipyretics. Cat's whiskers plant is a herbal medicine widely used empirically (hereditary) and believed to have a diuretic effect. Some countries trust and use this plant to treat diseases such as hypertension, atherosclerosis, kidney inflammation, fever, influenza, hepatitis, diabetes, etc.

Pharmacological Action of Cat's Whiskers *(Orthosiphon stamineus)* for Arthritis

Orthosiphon stamineus, commonly known as Cat's Whiskers, exhibits significant pharmacological potential in the management of arthritis due to its rich composition of active phytochemicals, including rosmarinic acid, sinensetin, eupatorin, caffeic acid, and various flavonoids. These bioactive compounds contribute to its pronounced anti-inflammatoryand analgesic effects. Research has demonstrated that extracts from *O. stamineus* inhibit key pro-inflammatory mediators such as tumor necrosis factor-alpha (TNF-α), interleukin-1 beta (IL-1β), and cyclooxygenase-2 (COX-2), which are critical in the progression of rheumatoid arthritis. Notably, rosmarinic acid plays a pivotal role in modulating immune responses and suppressing joint inflammation. In addition to its anti-inflammatory action, ethanolic leaf extracts of the plant have shown promising analgesic properties in experimental models, reducing arthritis-induced joint pain. Furthermore, the plant's antioxidant capacity enables it to protect cartilage from degradation by scavenging reactive oxygen species and reducing oxidative stress within the synovial fluid. The inhibition of inflammatory enzymes such as lipoxygenase (LOX) and cyclooxygenase (COX) further reinforces its therapeutic potential in preventing cartilage damage and alleviating symptoms associated with arthritis.[8,9]

Pharmacological Action of *Orthosiphon stamineus* in Kidney Stone Management

Orthosiphon stamineus, commonly known as Cat's Whiskers or Java Tea, exhibits significant pharmacological effects in the prevention and treatment of kidney stones (urolithiasis). Traditionally used in Southeast Asian and European herbal medicine, this plant contains

bioactive compounds such as rosmarinic acid, sinensetin, eupatorin, and orthosiphons that contribute to its diuretic, antioxidant, anti-inflammatory, and anti-urolithiatic activities.

The diuretic action enhances urine flow, aiding in the flushing out of crystals and small stones from the urinary tract. Rosmarinic acid has been shown to inhibit calcium oxalate crystal formation, the most common component of kidney stones. Additionally, the antioxidant and anti-inflammatory effects protect renal tubular cells from oxidative stress and inflammation triggered by stone formation.[7,10]

Pharmacological Action of *Orthosiphon stamineus* in Diabetes Management

Orthosiphon stamineus, commonly known as Cat's Whiskers or Java Tea, possesses significant antidiabetic properties, which have been validated in both preclinical and clinical studies. The plant contains key bioactive constituents such as rosmarinic acid, sinensetin, eupatorin, orthosiphol A, and various flavonoids and polyphenols, which contribute to its blood glucose-lowering effects. These compounds exert hypoglycemic effects by enhancing insulin sensitivity, stimulating glucose uptake, and inhibiting α-glucosidase and α-amylase enzymes, which delay carbohydrate digestion and absorption in the intestine. Furthermore, *O. stamineus* exhibits strong antioxidant and anti-inflammatory activities, which play a crucial role in protecting pancreatic β-cells from oxidative stress-induced damage, a key contributor to the progression oftype 2 diabetes mellitus. Animal studies have shown that administration of aqueous or ethanolic extracts of *O. stamineus* significantly lowers fasting blood glucose, HbA1c, and lipid profile markers. These effects are comparable to standard antidiabetic drugs, indicating the potential of *O. stamineus* as a complementary therapy for managing diabetes and its complications.[6,11,37]

Pharmacological Action of *Orthosiphon stamineus* for Hypotensive Effect

Orthosiphon stamineus, commonly known as Cat's Whiskers or Java Tea, has demonstrated promising hypotensive (blood pressure-lowering) effects in preclinical studies. The plant contains a rich variety of bioactive compounds, including sinensetin, eupatorin, rosmarinic acid, and orthosiphols, which contribute to vasodilation and diuretic activities—both critical for reducing blood pressure.

Experimental studies in hypertensive animal models have shown that extracts of *O. stamineus* can significantly reduce systolic and diastolic blood pressure, likely through enhancement of nitric oxide production, inhibition of angiotensin-converting enzyme (ACE) activity, and

antioxidant protection of vascular endothelium. Its mild diuretic properties also help reduce plasma volume, thus lowering blood pressure. These actions together make Cat's Whiskers a potential natural antihypertensive agent, particularly for mild to moderate hypertension.[14,15]

Pharmacological Action of Cat's Whiskers (Orthosiphon stamineus) in Hyperlipidemia Management

Orthosiphon stamineus, widely known as Cat's Whiskers or Java Tea, has shown promising pharmacological potential in the management of hyperlipidemia, a major risk factor for cardiovascular diseases. Rich in bioactive compounds such as flavonoids (sinensetin, eupatorin), phenolic acids (rosmarinic acid, caffeic acid), and terpenoids, this medicinal plant exerts potent hypolipidemic, antioxidant, and anti-inflammatory effects. Experimental studies in high-fat diet and cholesterol-induced animal models have demonstrated that O. stamineus extract significantly reduces serum total cholesterol, triglycerides, and LDL-cholesterol and improves HDL-cholesterol levels. The lipid-lowering action is believed to be mediated by modulation of lipid metabolism enzymes such as HMG-CoA reductase, enhancement of bile acid excretion, and upregulation of antioxidant defenses that prevent lipid peroxidation. Furthermore, O. stamineus reduces oxidative stress markers and improves liver histopathology, indicating protection against fat-induced hepatic injury. These findings support its use as a natural lipid-lowering agent, either alone or as an adjunct to conventional therapies.[12,13]

Phytochemicals

Cat whiskers also have the potential to be used as additives or active substances in cosmetics. The plant *Orthosiphon stamineus* has been commonly reported to contain various secondary metabolites, including flavonoids, saponins, tannins, and essential oils. Within the spectrum of bioactive components, phenolic compounds stand out as a paramount group of bioactive constituents prominently found in *Orthosiphon stamineus*. These bioactive constituents have been observed to significantly contribute to the antioxidant potential of the crude extract derived from *Orthosiphon stamineus*. Antioxidants disrupt radical chain oxidation by providing a hydrogen atom from the hydroxyl group within a stable end product, thereby preventing theinitiation or continuation of subsequent oxidative reactions. The foremost and pivotal initial stage in the examination of medicinal flora involves the process of extraction, as it is imperative for the isolation of the targeted bioactive compound from the plant material, facilitating subsequent investigations such as fractionation and purification.[16]

Flavonoid Compounds in Cat's Whiskers Plant *(Orthosiphon stamineus)*

Flavonoids are among the most abundant and pharmacologically active compounds in *Orthosiphon stamineus*. These compounds are primarily responsible for their antioxidant, anti-inflammatory, antihypertensive, antidiabetic, and anti-cancer properties.[17,18]

➢ Major Flavonoids Identified in *Orthosiphon stamineus*

Flavonoid Compound	Structure Type	Known Bioactivities
Sinensetin	Polymethoxylated flavone	Anti-hypertensive, anti-inflammatory, antioxidant
Eupatorin	Polymethoxylated flavone	Cytoto (Anticancer),anti-inflammatory, antioxidant
3'-Hydroxy-5,6,7,4'-tetramethoxyflavone	Polymethoxylated flavone	Antihypertensive, Vasodilation
Luteolin	Flavone	Anti-inflammatory, antioxidant, neuroprotective
Apigenin	Flavone	Anti-cancer, anti-inflammatory
Quercetin	Flavonol	Anti-oxidant, cardioprotective, anti-diabetic
Kaempferol	Flavonol	Anti-inflammatory, neuroprotective
Isoscutellarein derivatives	Flavone glycosides	Anti-oxidant, Hepatoprotective

Extraction & Identification Techniques

Flavonoids from *O. stamineus* are typically extracted using methanol, ethanol, or aqueous solvents and identified via:

- HPLC-DAD
- LC-MS/MS
- NMR Spectroscopy

Phenolic Acids in Cat's Whiskers Plant *(Orthosiphon stamineus*)

Phenolic acids are a major class of bioactive compounds found in *Orthosiphon stamineus* (Cat's Whiskers), contributing to its strong antioxidant, anti-inflammatory, nephroprotective, and antidiabetic properties. These compounds are primarily concentrated in the leaves and are often co-extracted alongside flavonoids.[11,19]

➢ Phenolic Acids Identified in *O. stamineus*

Phenolic Acid	Structure Name	Biological Activities
Rosmarinic acid	Caffeic acid derivative	Antioxidant, anti-inflammatory, neuroprotective, nephroprotective
Caffeic acid	Hydroxycinnamic acid	Antioxidant, anti-diabetic, hepatoprotective
Chlorogenic acid	Ester of caffeic acid	Glucose metabolism modulation,

		antioxidant, anti-obesity
Ferulic acid	Methoxylated hydroxycinnamate	Anti-inflammatory, anti-aging, and cardiovascular protection
p-Coumaric acid	Hydroxycinnamic acid	Antioxidant, anti-inflammatory, antimicrobial
Vanillic acid	Benzoic acid derivative	Antimicrobial, Neuroprotective, liver-protective
Syringic acid	Dimethoxybenzic acid	Antioxidant, anti-diabetic, cardioprotective

Extraction & Analysis Techniques

➢ **Extraction Solvents**

- Aqueous, methanolic, or hydroalcoholic (most effective for polar phenolics)

➢ **Analytical Methods**

- HPLC-DAD (High-Performance Liquid Chromatography with Diode Array Detection)
- LC-MS/MS for compound confirmation
- UV-Vis spectroscopy for total phenolic content (via Folin-Ciocalteu method)

Terpenoids in *Orthosiphon stamineus* (Cat's Whiskers Plant)

Orthosiphon stamineus is rich in a variety of phytochemicals, including terpenoids, which contribute to its medicinal properties such as anti-inflammatory, anticancer, and antimicrobial effects. Terpenoids are secondary metabolites derived from isoprene units and are crucial for plant defense and therapeutic applications.[20,21]

➢ **Terpenoids Identified in *Orthosiphon stamineus***

- Orthosiphol A, B, C, and D – diterpenoids isolated from the leaves.
- Staminol A – another diterpenoid showing hepatoprotective and anti-inflammatory properties.
- Neoorthosiphols and other abietane-type diterpenes – reported in some phytochemical studies.
- These compounds have demonstrated bioactivities such as antioxidant, antimicrobial, and cytotoxic effects in preclinical models.

Essential Oils from *Orthosiphon stamineus* (Cat's Whiskers)

Essential oils extracted from *Orthosiphon stamineus* contain a complex mixture of volatile compounds, many of which contribute to its medicinal value. These oils are typically

obtained from the aerial parts (leaves and stems) through methods such as hydrodistillation or steam distillation.[22,2]

➢ **Major Essential oils identified in *Orthosiphon stamineus***

- β-Caryophyllene – anti-inflammatory, analgesic.
- α-Humulene – anti-inflammatory, antibacterial.
- Germacrene D – antimicrobial.
- Limonene – antioxidant, mood-lifting.
- 1,8-Cineole (Eucalyptol) – anti-inflammatory, respiratory benefits.
- α-Pinene – bronchodilator, antimicrobial.
- Camphor – antifungal, insect-repelling.
- Thymol is – strong antimicrobial agent.

Saponins Reported from *Orthosiphon stamineus*

Although saponins in *O. stamineus* are not as well-characterized as flavonoids or phenolic acids, several studies have confirmed their presence through phytochemical screening, LC-MS, and TLC techniques.[23]

➢ **Biological Activities of Saponins**

- Anti-inflammatory – through inhibition of cytokines and COX-2 enzymes.
- Antioxidant – by scavenging free radicals.
- Antihyperglycemic – by enhancing insulin secretion and glucose uptake.
- Cholesterol-lowering – due to bile acid binding.
- Immunomodulatory – by modulating macrophage activity.

Cat's Whiskers(*Orthosiphon stamineus*) of Chemical Constituents, Therapeutic uses & Duration[27,28,29]

Constituent	Category	Therapeutic Use	Disorders\Diseases	Duration of use
Rosmarinic acid	Phenolic compound	Anti-inflammatory, antioxidant, nephroprotective	Arthritis, kidney stones, and hypertension	2-12 weeks
Sinensetin	Flavonoid	Anti-inflammatory, Antioxidant, anti-cancer	Inflammation, Cancer, and diabetes	4-8 weeks
Eupatorin	Flavonoid	Anti-cancer, Anti-proliferative	Cancer(colon,breast), metabolic disorders	2-6 weeks

Orthosiphol A	Diterpene	Diuretic, Anti-diabetic	Hypertension, diabetes, and kidney dysfunction	4-12 weeks
Caffeic acid	Phenolic acid	Anti-oxidant, hepatoprotective	Liver disorders, oxidative stress	2-8 weeks
Methylripariochromene A	Chromene compound	Anti-hyperuricemic, anti-inflammatory	Gout, hyperuricemia	1-4 weeks
Ursolic acid	Triterpenoid	Anti-inflammatory, hepatoprotective, anti-obesity	Liver disease, obesity, cancer	4-10 weeks
Stigmasterol	Phytosterol	Hypolipidemic, anti-inflammatory	Hyperlipidemia, cardiovascular disease	6-12 weeks
Betulinic acid	Triterpenoid	Anti-cancer, anti-HIV	Cancer, viral infections	2-6 weeks
Potassium salts	Inorganic mineral	Diuretic, electrolyte balance	Edema, kidney stones, and hypertension	1-6 weeks

[30,31,32]

Phytochemical Screening of *Orthosiphon stamineus*: Chemical Tests for Major Constituents

Preliminary phytochemical screening is a fundamental procedure in the pharmacognostic evaluation of medicinal plants, serving as a rapid and cost-effective method for identifying the presence of major classes of bioactive compounds. In the case of *Orthosiphon stamineus Benth.*, commonly referred to as Cat's Whiskers or Java Tea, various secondary metabolites have been extensively documented. These include flavonoids, phenolic acids, terpenoids, saponins, alkaloids, and essential oils, all of which are believed to contribute significantly to the plant's wide range of pharmacological effects, such as antioxidant, anti-inflammatory, diuretic, and antihypertensive activities. The identification of these phytochemicals is typically achieved through classical qualitative chemical tests that rely on specific color changes or precipitate formation upon reaction with diagnostic reagents. Such tests include the Shinoda test for flavonoids, the ferric chloride test for phenolics, the Salkowski test for terpenoids, the froth test for saponins, Wagner's test for alkaloids, and steam distillation followed by thin-layer chromatography (TLC) or gas chromatography–mass spectrometry (GC-MS) for essential oils. These classical assays provide a foundational understanding of the phytochemical profile *of O. stamineus,* guiding further quantitative and structural analyses using advanced chromatographic and spectroscopic techniques. Collectively, these screening methods validate the traditional medicinal use of the plant and support its continued exploration in pharmacological and phytochemical research.[33,34,35]

Phytoconstituent	Chemical Test	Procedure	Positive Indication
Flavonoids	Shinoda Test (Qualitative)	Extract is treated with magnesium turnings and conc. HCL.	Appearance of pink or red coloration
Phenolic Acids	Ferric Chloride Test (Qualitative)	5% FeCl3added to extract	Formation of deep blue or green color
Terpenoids	Salkowski Test (Qualitative)	Extract mixed with chloroform, and conc.H_2SO_4 is added arefully.	Reddish- brown layer at the interface
Saponins	Froth Test (Qualitative)	Aqueous extract shaken vigorously for 10-15 min.	Stable froth persisting >10 minutes.
Alkaloids	Wagner's Test	Extract treated with Wagner's reagent (iodine in KI).	Reddish-brown precipitate forms
Essential oils	Steam distillation + TLC	Volatile oil extracted via distillation; analyzed using TLC or GC-MS.	Detection of aromatic oil layer or peaks

Traditional Preparation of Java Tea *(Orthosiphon stamineus)*

Orthosiphon stamineus, commonly known as Java Tea, is traditionally prepared by decocting or infusing the dried aerial parts of the plant, particularly the leaves. This herbal preparation method is widely practiced in Southeast Asian countries such as Malaysia, Indonesia, Thailand, and Vietnam, where *O. stamineus* holds a prominent place in ethnomedicine. The traditional process begins with the harvesting of leaves—sometimes accompanied by stems and flowers—during the flowering phase, which is believed to yield the highest concentration of bioactive phytochemicals. These plant parts are thoroughly washed and subjected to shade-drying to preserve their volatile and heat-sensitive compounds. Once dried, the material is crumbled into smaller pieces and stored in airtight containers for later use.

In some traditional settings, additional herbs and flavor-enhancing agents are included. Common additives include ginger, lemongrass, or honey, which not only improve taste but also contribute synergistic medicinal effects. Furthermore, *O. stamineus* is occasionally used in polyherbal formulations alongside plants such as Andrographis paniculata and Centella asiatica to broaden its therapeutic profile. These preparation techniques, passed down through generations, reflect the plant's long-standing use in folk medicine and contribute to its sustained popularity in both traditional and modern herbal practices.[25,26,2]

Clinical Studies of Anti-obesity and Lipid-Modifying Properties of Orthosiphon stamineus

The metabolic regulatory potential of Orthosiphon stamineus (OS) has been supported by clinical findings, particularly in the context of body weight and lipid profile modulation. In a randomized, double-blind, placebo-controlled trial, Adam et al. (2015) evaluated the efficacy

of OS leaf extract in overweight individuals with a body mass index (BMI) ≥25 kg/m². The study enrolled 90 participants, who were randomly assigned to receive either 250 mg of standardized O. stamineus extract or a matching placebo, administered twice daily for a period of 12 weeks. The extract was standardized to ensure consistency in key bioactive constituents, notably flavonoids and terpenoids.

Study Design

This trial was designed as a double-blind, placebo-controlled study with two arms:

- Intervention group: 250 mg OS extract, twice daily (BID)
- Control group: Placebo, BID

All participants were instructed to maintain their usual dietary and physical activity patterns without any additional lifestyle modifications.

Outcome Measures

The study evaluated both primary and secondary endpoints

- Primary outcomes included changes in body weight, BMI, and waist circumference.
- Secondary outcomes included alterations in serum lipid profile, specifically total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides.

Key Findings

After 12 weeks of intervention, participants in the O. stamineus group demonstrated a significant reduction in body weight compared to placebo (mean weight loss of approximately 2.6 kg, $p < 0.05$). A corresponding decrease in BMI was also observed ($p < 0.05$). Furthermore, LDL cholesterol levels were significantly reduced in the treatment group ($p < 0.01$), indicating a favorable lipid-modifying effect. However, no significant differences were found in HDL cholesterol or triglyceride levels between the groups.

Importantly, the intervention was well tolerated, and no serious adverse events were reported throughout the study duration. These findings suggest that O. stamineus may offer modest but clinically relevant benefits in managing obesity-related parameters, likely mediated by its phytochemical constituents such as sinensetin, eupatorin, and other flavonoids with potential lipase-inhibitory and antioxidant activities.[37,29]

Toxicological Studies

Several studies investigated the possible toxic effects oforally administered O. stamineus extract in rats. Toxicitywas evaluated by measuring the 50% lethality dose, side-cage observation, and the analysis of some biochemical parameters. 23,66–68During the experiment, no lethality, adverse manifestations, or delayed toxic effects were seen at a dose of up to 5 g/kg. It is surprising that, in one study, liver hypertrophyalong with a peculiar significant drop in hepatic transaminase enzymes were observed at the end of the study.49Despite that, the authors suggested that *O. stamineus* methanolextract is practically nontoxic, and the 14 days of 5g/kgfeeding is regarded as within the non-observable adverseeffect level. However, the increase in liver size in the absence of any significant changes in liver enzymes is questionable and warrants further investigation. 67Recently, genotoxicity of *O. stamineus* has been evaluated by Muhammad et al.68using the Salmonella/microsome mutation and the mouse bone marrow micronucleus assays. The Salmonella/microsome assay (TA97aTA98, TA100, and TA1535; plate incorporation method)was performed in the presence or absence of extrinsicmetabolic activation (S9 mixture). Results showed that atdoses up to 5000 µg per plate, the aqueous extract of *O.stamineus* was not toxic to Salmonella test strains and didnot increase the number of revertant colonies over thebackground incidence. Moreover, in the mouse bone marrow assay, the extract did not alter the polychromatic:monochromatic erythrocyte ratio, nor did it increase theincidence of micronucleated polychromatic erythrocytes. No overt toxicity or changes in CYP1A and 2B9/10 activities were noted. Therefore, Muhammad et al.68concludedthat the use of *O. stamineus* in traditional medicine poses nogenotoxic risk.[24]

DISCUSSION

Further research is needed to fully realize the therapeutic potential of *Orthosiphon stamineus.* Standardizing extraction methods is crucial to ensure consistency in bioactive compounds and efficacy. Clinical trials are necessary to evaluate the safety and effectiveness of the plant in humans. Additionally, investigating optimal dosages and potential interactions with other medications will help healthcare professionals and patients use it safely. By exploring its potential applications in managing various health conditions, researchers can unlock new opportunities for natural remedies and pharmaceutical development.

CONCLUSION

Orthosiphon stamineus, commonly known as Cat's Whiskers or Java Tea, has emerged as a promising medicinal plant with a rich ethnobotanical history and diverse pharmacological properties. Its traditional use in Southeast Asian countries for managing various health conditions, including kidney and urinary disorders, hypertension, diabetes, and inflammation, has been validated by modern scientific research. The plant's bioactive compounds, including flavonoids, phenolic acids, diterpenoids, and essential oils, contribute to its antioxidant, anti-inflammatory, antihypertensive, antidiabetic, and nephroprotective effects. While preclinical studies have demonstrated its therapeutic potential, further research is needed to standardize extraction methods, conduct clinical trials, and assess toxicological profiles to ensure its safe and effective use in modern phytotherapeutics. Overall, *Orthosiphon stamineus* represents a valuable resource for the development of natural remedies and potential pharmaceutical applications.

REFERENCE

1. Kamran Ashraf et. al, Journal of Pharmacy and Bioallied Sciences, Jul-Sep 2018;10 (3): 109-118, DOI: 10.4103/jpbs.JPBS_253_17.
2. Omar Z.Ameer, Ibrahim M. et.al, *Orthosiphon stamineus*: Traditional uses, phytochemistry, pharmacology and Toxicology, Journal of Medicinal Food, 30 July 2012, DOI:10.1089/jmf 2011.1973.
3. Qirou Wang et.al, A Systematic Review of *Orthosiphon stamineus Benth*. In the Treatment of Diabetes and its complications, molecules 2022; 27(2): 444; 10 Jan 2022, DOI:10.3390/molecules27020444.
4. Suddee, S., Paton, A.J. & Parnell, J.A.N. Taxonomic Revision of the tribe Ocimeae Dumort *(Lamiaceae*) in continental South East Asia III. Ociminae. Kew Bulletin, 2005; 60: 3-75.
5. Hae-Jung Lee et.al, Hexane Extract of Orthosiphon Induces Insulin Expression and Prevents Glucotoxicity in INS-1 Cells, Diabetes and Metabolism Journal, 2015; 39(1): 51-58, 16 February 2015, DOI:10.4093/2015;39.1.51.
6. Elsnoussi Ali Hussin Mohamed et.al, Antihyperglycemic Effect of *Orthosiphon Stamineus Benth* Leaves Extract and Its Bioassay-Guided Fractions, Molecules, 2011; 16(5): 3787-3801; 4 May 2011 DO:10.3390/molecules16053787.

7. Yudith Yunia Kusmala et.al, Potentials of the cat's whisker plants *(Orthosiphon stamineus)* for kidney health, vol. 2 No. 3(2023): Journal of Health and Dental Science, 2023-01-30, DOI:10.54052/jhdsv2n3.p387-404.
8. Hil JM Heiligers et.al, Diagnoses and visit length in complementary and mainstream medicine, BMC Complementary and Alternative Medicine, 2010; 10(3): 25 Jan 2010.
9. Tabana YM et.al, Cat's whiskers (*Orthosiphon stamineus*) tea modulates arthritis pathogenesis via the angiogenesis and inflammatory cascade, BMC Complement Altern Med., 2016 Nov 24; 16(1): 480. DOI: 10.1186/s12906-016-1467-4.
10. Ambursa et. al, An In vitro Study of *Orthosiphon stamineus* (MisaKucing) Standardized Water Extract as a Chemolytic Agent in Urolithiasis, Journal of Pharmacy and Bioallied Sciences 13(4): 373-379, Oct–Dec 2021. | DOI: 10.4103/jpbs.jpbs_526_21.
11. Yi L. Ngo, Lee S. Chua, Anti-diabetic Activity of Rosmarinic Acid Rich Fractions from *Orthosiphonstamineus*, 2018; 14(2): DOI: 10.2174/1573408014666180101144331.
12. Seyedan A et.al, Antiobesity and Lipid-Lowering Effects of *Orthosiphon stamineus* in High-Fat Diet-Induced Obese Mice. Planta Med., 2017 May; 83(8): 684-692. DOI: 10.1055/s-0042-121754.
13. Ameer OZ et.al, *Orthosiphon stamineus*: traditional uses, phytochemistry, pharmacology, and toxicology. J Med Food, 2012 Aug; 15(8): 678-90. DOI: 10.1089/jmf.2011.1973.
14. Lehman L et.al, Similarity-Based Searching in Multi-Parameter Time Series Databases. Comput Cardiol, 2008; 35(4749126): 653-656. DOI: 10.1109/CIC.2008.4749126.
15. Lee Han Jie et. al, Sinensetin: An Insight on Its Pharmacological Activities, Mechanisms of Action and Toxicity, 2020; 11: 20 Jan 2021, DOI:10.3389/fphar 2020.553404.
16. Indah Puspita Sari, Phytochemical screening and free radicals-scavenging activity of *Orthosiphon stamineus* (cat's whiskers) leaves, 2024; 2(2): Indonesian Journal of Cosmetics, 20 Jan 2023.
17. Deipenbrock M, Hensel A. Polymethoxylated flavones from *Orthosiphon stamineus* leaves as antiadhesive compounds against uropathogenic E. coli. Fitoterapia, 2019 Nov; 139: 104387. DOI: 10.1016/j.fitote.2019.104387
18. L, V., A., S., & M.Z., A. Isolation of Flavones from The Anti-inflammatory Fraction of *Orthosiphon Stamineus* Extracts. Malaysian Journal of Science, 2005; 24(1): 125–128.
19. Saidan et al. BMC Complementary and Alternative Medicine 2015; 15: 350, DOI: 10.1186/s12906-015-0884-0.
20. Awale S et.al, Five novel highly oxygenated diterpenes of *Orthosiphon stamineus* from Myanmar. J Nat Prod, 2001 May; 64(5): 592-6. DOI: 10.1021/np000607t.

21. Awale S et.al, Four highly oxygenated isopimarane-type diterpenes of *Orthosiphon stamineus*. Planta Med., 2002 Mar; 68(3): 286-8. DOI: 10.1055/s-2002-23137.
22. Nuramirah Azizan et.al, Composition and Antibacterial Activity of the Essential Oils of *Orthosiphon stamineus Benth* and Ficus deltoidea Jack against Pathogenic Oral Bacteria, Molecules, 2017; 22(12): 2135; 5 December 2017, DOI:10.3390/molecules22122135.
23. Neli-kinga Olah et.al, Phytochemical and pharmacological studies on Orthosiphon stamineus Benth, October 2003. Journal of Pharmaceutical and Biomedical Analysis, 33(1): 117-23, DOI:10.1016/S0731-7085(03)00227-9.
24. H. Muhammad et.al, Evaluation of the genotoxicity of *Orthosiphon stamineus* aqueous extract, Journal of ethnopharmacology, 133(2): Pagination 647 - 653, ISSN 0378-8741.
25. Mun Fei Yam et.al, An Investigation of the Anti-Inflammatory and Analgesic Effects of *Orthosiphon stamineus* Leaf Extract, Journal of Medicinal Food, 2 July 2008; 11(2): DOI:10.1089/JMF.2006.065.
26. Disatapornjaroen W et.al, A long-term study on the efficacy of a herbal plant, *Orthosiphon grandiflorus*, and sodium potassium citrate in renal calculi treatment. Southeast Asian J Trop Med Public Health, 2001 Sep; 32(3): 654-60. PMID: 11944733.
27. Arrigo Francesco Giuseppe Cicero et.al, Effect of a combined nutraceutical containing *Orthosiphon stamineus* on blood pressure and metabolic syndrome components in hypertensive dyslipidaemic patients: A randomized clinical trial, Complementary Therapies in Clinical Practice, August 2012; 18(3): 190-4, DOI:10.1016/j/j.j.ctcp.2012.02.002.
28. Seyedan A, Alshawsh MA, Alshagga MA, Mohamed Z. Anti-obesity and Lipid Lowering Effects of Orthosiphon stamineus in High-Fat Diet-Induced Obese Mice. Planta Med., 2017 May; 83(8): 684-692. Doi: 10.1055/s-0042-121754.
29. YiL.Ngo and Lee S.Chua*, Anti-diabetic Activity of Rosmarinic Acid Rich Fractions from *Orthosiphon stamineus*, Current Enzyme Inhibition, 14(2): 2018; DOI: 10.2174/1573408014666180101144331.
30. Yam, M.F., Ang, L.F., Basir, R. et al. Evaluation of the anti-pyretic potential of *Orthosiphon stamineus Benth* standardized extract. Inflammo pharmacology, 2009; 17: 50–54. DOI:10.1007/s10787-008-8038-3.
31. Chao Y, Gao S, Li N, Zhao H, Qian Y, Zha H, Chen W, Dong X. Lipidomics Reveals the Therapeutic Effects of EtOAc Extract of *Orthosiphon stamineus* Benth. On Nephrolithiasis. Front Pharmacol, 2020 Aug 21; 11: 1299. DOI: 10.3389/fphar2020.01299.

32. Yam, M. F. et al.– "Antioxidant and hepatoprotective effects of *Orthosiphon stamineus.* Identified sinensetin, eupatorin, and 3'-hydroxy-5,6,7,4'-tetramethoxyflavone using HPLC. Doi:10.1142/S0192415X07004511 2007.
33. Chitra Sivakumar and Karthikeyan Jeganathan, Phytochemical profiling of cat whisker's (Orthosiphon stamineus) tea leaves extract, Journal of pharmacognosy and Phytochemistry, 2018; 7(6): 1396-1403.
34. Indah Puspita Sari et.al, Phytochemical Screening and Free Radical-Scavenging activity of Orthosiphon stamineus (cat whiskers) leaves, Indonesian Journal of Cosmetics 1(1): DOI:10.35472/ijcos.v1i1.1639.
35. Neli-Kinga Olah et.al, Phytochemical and pharmacological studies on Orthosiphon stamineus Benth, October 2003. Journal of pharmaceutical and biomedical Analysis 33(1): 117-23. DOI:10.1016/S0731-7085(03)00227-9.
36. Adam, Y., Somchit, M. N., Sulaiman, M. R., Zuraini, A., Bustamam, A. A., & Abdullah, N. R. Anti-obesity and lipid-lowering effects of Orthosiphon stamineus in overweight individuals: A randomized, double-blind, placebo-controlled study. Complementary Therapies in Medicine, 2015; 23(6): 858–864, DOI: 10.1016/j.ctim.2015.08.002.
37. Qirou Wang et.al, A Systematic Review of Orthosiphon stamineus Benth. In the Treatment of Diabetes and Its Complications, National Library of Medicine, Molecules, 2022 Jan 10; 27(2): 444. DOI:10.3390/molecules27020444.
38. Venkatesan Natarajan et.al, Isolation and Characterization of Renal Protective Compounds from *Orthosiphon stamineus* Leaves: A Traditional Medicinal Plant, Journal of Young Pharmacists, 2025; 17(1): 123-129, 06 June 2025, DOI: 10.5530/jyp 20251477.