

Phytochemical and pharmacological review on *Stephania japonica*

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ABSTRACT

This paper reviews phytochemical and pharmacological profiles of *Stephania japonica* from the databases PubMed, Science Direct and Google Scholar up to December 2018. *S. japonica* is a common plant, widely distributed in all over Bangladesh. Traditionally, this plant is considered as one of the important medicinal plants in the treatment of a variety of ailments, including inflammation, pain, rheumatism, cancer, bone fracture and fever. Findings suggest that *S. japonica* is rich in important phytochemicals, including alkaloids, steroids, saponins and fats. It is evident to possess anti-inflammatory, antioxidant, antidiarrheal, antimicrobial, insecticidal, anti-nociceptive, neuro-protective, analgesic and anti-hyperglycaemic activities. In conclusion, *S. japonica* may be one of the best sources of plant-based active constituents.

Keywords: *Stephania Japonica*; Phytochemicals; Pharmacological activities

Introduction

Plants have been used in traditional medicine since ancient time with a reputation as efficacious remedies regardless of insufficient scientific evidence to substantiate their efficacy. The exploration of the chemical properties of the plants throughout the age was accomplished principally through careful observation, trial and error and the accidental discovery. In this process, the human race, over the centuries, has created a vast heritage of knowledge and experience on medicinal plants in different cultures and civilizations. Most of such indigenous knowledge handed down, through the ages, by oral tradition. The major portion of the present-day knowledge of the medicinal properties of the plants is thus the sum total of these observations and experience [1]. The plant *Stephania japonica* Linn. belongs to the family Menispermaceae, a slender wiry climber or twining shrub [2], is widely used in the traditional medicine of Bangladesh in the treatment of a wide range of diseases and disorders, including inflammation, cancer, asthma, fever, sleep disturbance, edema, and bone fracture [3,4]. Especially its leaves, are extensively used to treat different kinds of painful conditions, more specifically, the crushed leaves for body pain [4,5]

and warmed leaves for rheumatism [6]. In 1982, Matsui have isolated two hasubanan type alkaloid oxostephaniamine (284 mg) and 16-oxoprometaphanine (238.5 mg) and one bisbenzylisoquinoline type alkaloid stebisimine (192.5 mg) from the methanolic extract *S. japonica* leaves. This review aimed at sketching a current scenario on the phytochemical and pharmacological activities of *S. japonica* on the basis of scientific reports found in PubMed, Science Direct and Google Scholar databases up to December 2018.

Findings

Plant Morphology

S. japonica is a slender wiry climber. Leaves peltate, thinly papery, glabrous on both the surfaces, broadly triangular, ovate-acuminate, 3-12 cm long, apex acutely acuminate or obtuse, base rounded, margins entire. Inflorescence axillary, compound, umbelliform cymes, usually single per axil, 3-6 cm long. Flowers small, male flower greenish-white or yellowish. Drupes light yellow to orange red, obovate, glabrous [7].

Taxonomy

Kingdom: Plantae
Order: Ranunculales
Family: Menispermaceae
Genus: *Stephania*
Species: *S. japonica*

Synonyms

S. hernandifolia Walp., *Menispermum japonicum* Thunb.
Bengali/Vernacular Name: Akanadi, Nimuka, Maknadi.
Tribal Name: Tung Nah Way, ThayaNuya (Marma).
English Name: Tape-vine [7].

Traditional Uses

Leaves and roots are bitter and astringent; used in fever, diarrhoea, urinary diseases and dyspepsia. Leaves are mounted on the abscess and kept for bursting. Leaves are macerated in a glass of water and are taken after mixing with molasses to cure urethritis. Leaves are also given for gastritis in Khagrachari. On the other hand, tooth paste is taken for vertigo and dysentery; root tuber mixed with root juice of *Flemingia stricta* (Family: Leguminosae) is taken for asthma; the root paste is warmed and rubbed in hydrocele. The ethanolic leaf extract of the plant is evident to have broad spectrum anti-bacterial and anti-fungal activities [7,8].

Phytochemical Composition

Roots, tubers and leaves of *S. japonica* contain alkaloids, steroids and fats. Stems contain bis-benzylisoquinoline alkaloids, stephasubine and 3',4'-dihydro-stephasubine, saponins, steroids and fats. Roots contain the alkaloids, fangchinoline, dl-tetrandrine, d-tetrandrine and disochondrodendrine. Aerial parts of the plant contain aknadinine, epistephanine, hernandifoline and magnoflorine. Roots and tubers contain alkaloids - aknadinine, aknadine and aknadicine. A new alkaloid-3-O-di-methyl-hernandifoline was also isolated from the plant [7]. The plant is also evident to possess tannins, glycosides, flavonoids and [9].

Pharmacological Activities

Anti-Inflammatory Activity

The plant extract (methanol) has been found to show significant anti-inflammatory effect on egg albumin method [10]. Ahmed et al. [11] also suggested an anti-inflammatory effect of the plant.

Antioxidant Activity

The crude extract of the plant is evident to scavenge 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical at 20-200 µg/ml [11,12]. The IC₅₀ values were calculated as 33.57 µg/ml [12].

Anti-Diarrheal Activity

S. japonica ethanol extract at dosage level 0.5, 1 and 2 g/kg decreased the gastrointestinal motility and number of feces in rats (n = 5) (Chatterjee, 1993).

Anti-Microbial and Cytotoxic Effect

Ethyl acetate soluble fraction of the *S. japonica* extract was found to act against *Salmonella typhi*, *Escherichia coli* and *Bacillus cereus*. The zones of inhibition produced by the crude methanolic extract, n-hexane, chloroform and ethyl acetate soluble fractions were found to be 12.80-16.55 mm, 12.60 mm, 5-14.30 mm and 10-20.25 mm, respectively, at a concentration of 30 g/disc (Rahman). Chloroform, n-hexane and ethyl acetate soluble fractions of methanolic extract of *S. japonica* were also found to produce a concentration-dependent cytotoxic effect in brine shrimps. The chloroform and ethyl acetate soluble fractions of methanolic extract of *S. japonica* showed cytotoxicity (with LC₅₀ 66.488 and 45.662 mg/ml, respectively) (Rahman).

Insecticidal Activity

1, 5 and 10 mg solutions of plant extract (acetone fraction) exhibited the insecticidal effect [13]. The plant is also evident to act against *Callosobruchus chinensis* where at dose 5 mg, it achieved 50% death of test insect [14].

Anti-Nociceptive Activity

S. japonica is evident to show analgesic effect in mice [15]. The methanolic extract of the plant at 50, 100, and 200 mg/kg was evident to show an anti-nociceptive effect in mice [9].

Neuro-Protective Activity

In a recent study, methanolic extract of the herb showed a neuroprotective effect, possibly by reducing oxidative stress, neuroinflammation and inhibiting cholinesterase activity [10].

Anti-Hyperglycemic Effect

The methanolic extract of the plant at 250 and 500 mg/kg is evident to exert an anti-hyperglycemic effect in experimental rats [16]. *S. japonica* mediated anti-hyperglycemic effect was also seen by Ueda et al. [17], Gregersen et al. [18] and Hossain et al. [19].

Discussion

There is a relation between oxidative stress and inflammation [20]. Phenolic natural compounds such as flavonoids possess antioxidant and anti-inflammatory activity [21]. It is well established that the first phase of formalin test reflects neurogenic pain and the late phase corresponds to inflammatory pain responses [22]. Thus, the antioxidant and anti-inflammatory responses are the best sign of probable potent *S. japonica*-based constituents for the traditional usages, especially in inflammation and pain. Medicinal plant extracts offer considerable potential for the development

of new agents effective against pathogens that are currently difficult to treat [23]. Noxious stimuli or infection is also related to inflammation cells [20]. *S. japonica* mediated antimicrobial effect is also evident in scientific report (Rahman). Recent evidence indicates that cytokines (and chemokines), as well as their receptors, are involved in the pathophysiology of many inflammatory diseases including sepsis, rheumatoid arthritis atherosclerosis and asthma. These pathological states seem to be linked with an imbalance of cytokine network and to the excessive recruitment of leukocytes to the inflammatory sites [24,25] (Young).

Because of this, the cytokine system constitutes a very interesting and promising target for the development of clinically relevant anti-inflammatory drugs. Carrageenan induced paw edema in rats is thought to be biphasic [26]. In the second phase bradykinin, protease, prostaglandin, and lysosome are released [27]. Evidence supports that various plant-derived compounds with anti-inflammatory properties exert their effects through the modulation of cytokine system [28]. For instance, flavonoids, a class of compounds widely distributed throughout the plant kingdom possess interesting anti-inflammatory action [29]. So, resulting anti-inflammatory and antioxidant effect could be assumed either as the protective effect against oxidative stress or inhibition of enzymes of prostaglandin pathway or other enzymatic pathways of inflammatory process. Further, anti-inflammatory, anti-microbial and anti-diarrheal effects of *S. japonica* may be linked with each other. On the other hand, anti-hyperglycaemic and cytotoxic effects of the herb indicate potential sources of anti-diabetic and anti-cancer substances in it. Generally, antioxidant and anti-inflammatory effects are protective in nature [10]. Therefore, the neuroprotective capacity of the plant may be due to its antioxidant effects in different test systems [30-33].

Conclusion

S. japonica contains a number of important phytoconstituents and possesses prominent biological activities. More studies are necessary as *S. japonica* may be one of the best sources of phytomedicines.

Conflict of interest

None declared.

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