

REVIEW

**CENTELLA ASIATICA: A CONCISE DRUG REVIEW WITH  
PROBABLE CLINICAL USES**

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*Centella asiatica* (*Gotu kola*) is an imperative herb in Ayurvedic medicine, often mentioned in combination with the related European marsh pennywort (*Hydrocotyle vulgaris*). About 20 species recounted to *Gotu kola* cultivate in most parts of the tropic or wet pantropical areas such as rice paddies and also in rocky and higher elevations. *Centella asiatica* (*Gotu kola*) is known as longevity herb and used widely in India and Nepal as part of the traditional Ayurvedic medicine. In Samskṛita, it is called 'Maṇḍūkapaṇī' as its leaf appears as a standing frog from its backside. It is also called 'Brahmi the goddess of supreme wisdom and 'Saraswati the goddess knowledge & wisdom. Its roots and leaves are used for medicinal purposes and provide important health benefits related to healthy veins and blood vessels, to treat skin disorders, help with better memory and improve brain function.

*Key words:* *Centella asiatica*; lipidperoxidation (LPO); oxidative stress

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*Centella asiatica* (*Gotu kola*) is known as longevity herb and used widely in India and Nepal as part of the traditional Ayurvedic medicine. In Samskṛita, it is called 'Maṇḍūkapaṇī' as its leaf appears as a standing frog from its backside. It is also called 'Brāhmī' the goddess of supreme wisdom

and 'Saraswatī' the goddess knowledge & wisdom. Its roots and leaves are used for medicinal purposes and provide important health benefits related to healthy veins and blood vessels, to treat skin disorders, help with better memory and improve brain function.

**Name in Different Languages** – *Centella asiatica* is also known as Brahmi, Maṇḍūka Paṇī, Eka-panī in Sanskrit, Brahmanāṇḍūkī, Brāhmī Bheda, Khulakudi in Hindi, Tholkuri (Bhava Prakash.) in Assam and so on.

#### **Morphology and Habitat**

*Centella asiatica* is small creeping herb with shovel shaped leaves emerging alternately in clusters at stem nodes. This is a prostrate, sparingly hairy or nearly smooth herb. The stems root at the nodes. The leaves are rounded to reniform, 2 to 5 centimeters wide, horizontal, more or less cupped, rounded at the tip, and kidney-shaped or heart-shaped at the base, the rounded lobes often overlapping. The petioles are erect and long. The peduncles occur in pairs of three, are less than 1 centimeter long, and usually bear 3 sessile flowers. The petals are dark-purple, ovate, and about 1 millimeters long. The fruit is minute, ovoid, white or green, and reticulate, each with 9 sub similar longitudinal ridges. The runners lie along the ground and the inch long leaves with their scalloped edges rise above on long reddish petioles. The insignificant greenish- to pinkish-white flowers are borne in dense umbels on separate stems in the summer. Plant is also known as gotu kola and grows abundantly in shady, moist, or marshy areas. It is distributed widely in many parts of the world, including India, Sri Lanka, Madagascar, South Africa, Australia, China, and Japan (Zheng, 2007; Satake et al., 2007; *Centella asiatica*, 2007)

#### **Chemical constituents of *Centella asiatica*:**

The plant and its extract contain asiaticoside an active principle of *C. asiatica*, in which a trisaccharide moiety is linked to the aglycone asiatic acid. The other triterpenoid derivative isolated from *C. asiatica* is called madecassol. These triterpene saponins and their sapogenins are probably

responsible for the wound healing and vascular effects. Other components isolated from *C. asiatica*, such as brahmoside and brahminoside, may be responsible for CNS and uterorelaxant actions, but are yet to be confirmed by clinical studies. Crude extract that contains isothankuniside and thankuniside showed antifertility action in mice. Centelloside and its derivatives are found to be effective in the treatment of venous hypertension. In addition, the total extract contains plant sterols, flavonoids, and other components with no known pharmacological activity. Analyses of the essential oil of this medicinal plant revealed 11 monoterpenoid hydrocarbons (20.20%), nine oxygenated monoterpenoids (5.46%), 14 sesquiterpenoid hydrocarbons (68.80%), five oxygenated sesquiterpenoids (3.90%), and one sulfide sesquiterpenoid (0.76%). Humulene (21.06%), caryophyllene (19.08%), bicyclogermacrene (11.22%), germacrene B (6.29%), and myrcene (6.55%) were the predominant constituents. Crude extract that contains isothankuniside and thankuniside showed antifertility action in mice. (Duta and Basu, 1968, Duke, 1985). Many studies focus on the triterpenoids asiaticoside, centelloside, madecassoside, and asiatic acid (Randriamampionona et al., 2007). Asiaticoside has anxiolytic, (Liang et al., 2008) anti-inflammatory, antioxidant, antiulcer, and wound-healing properties. (Kimura et al., 2008). Asiaticoside and madecassoside may be effective in treating arthritis. (Liu et al., 2008). Asiatic acid induces apoptosis and cell cycle arrest in several types of cancer in rats.

#### **Conventional Pharmacodynamic properties -**

**Rasa:** Tikta, Kaṣāya, Madhura (*Bhāvprakaśa Nighaṇṭu*), (*Kaiyadeva Nighaṇṭu*)

**Anurasa:** *Kaṣāya, Madhura (Bhāvaprakaśa Nighaṇṭu)*

**Guṇa:** *Laghu, Sara*

**Vīrya:** *Śīta (Kaiyadeva Nighaṇṭu)*

**Vipāka:** *Madhura*

**Prabhāva:** *Medhya*

**Parts used:** Whole plant (leaves, seeds, fruits, roots, twigs, seeds etc) (Nadkarni 1927). Leaves raw or cooked are used in salads and in curries.

**Distinguished uses:** *Centella asiatica* is very well recognized drug and its 3 to 4 fresh leaves with 1-2 black pepper are given to children to reinforce the memory. This plant is used in nervous, blood and skin diseases. Plant is antiseptic, diuretic, used in leprosy, psoriasis, syphilitic ulcer, fever, dysentery, Rheumatism and bowel complaints. Leaves are tonic, rich in ascorbic acid; accelerate nervous activity, good for increasing memory. *Centella asiatica* contains a blend of compounds including at least 3 triterpenes (Asiatic acid, madecassic acid and asiaticoside) that appear to have antioxidant benefits and ability to stimulate collagen synthesis for tissue regeneration. They probably enhance formation of collagen in bones, cartilage and connective tissue. These substances work to promote healthy blood vessel by strengthening their wall and improving blood flow. The plant aids in wound healing and has been used in the treatment of leprosy and tuberculosis in Far East. Indian physicians use the plant as internal and external remedy in various skin diseases, ulcerations chronic and callous, scrofulous and syphilitic with gummatous infiltration (tertiary syphilis). It has been also used in chronic eczemas, psoriasis, leprosy, malaria, epilepsy, insanity etc. *Brāhmī* is one of the recognized drugs used for Rasāyana (Rejuvenation) purpose (C.Ci 1). Two common forms in which the

drug is used are *Svarasa* given as fresh juice and as a prepared *Ghṛta*. These improve the colour of the body, youth and memory and give long life (Nadkarni, 1927). It is a Medhya Rasayana. Improves intelligence (*Caraka Samhita*) and increases longevity (*Bhavaprakasha*). For mental weakness and for improving memory, powder of dried leaves in small dose is given with milk. In bowel complaints as well as fever of the children, the decoction of leaves is given with fenugreek seeds (Nadkarni, 1927). *Centella asiatica* urban is also known as *Brāhmī* in some parts of India. It has caused confusion in repetition of score *Brāhmī*.

#### **Some clinical action of *Centella asiatica*:**

It is an alternative, tonic, diuretic and local stimulant especially for the cutaneous system. It has a special influence on the genito-urinary tract; it sets up urinary and ovarian irritation and itching over the whole body. It has also an emmenagogoue action. In large doses it acts as a stupefying narcotic, produces headache, giddiness and in some people a tendency to coma. Internally the powder is alternative and tonic (Nadkarni 1927).

#### **Recent studies on the effects of *Centella asiatica* :**

A study conducted by K.G. Mohandas Rao and others showed a significant increase in the dendritic length (intersections) and dendritic branching points of both apical and basal dendrites in rats treated with 4 and 6 ml kg<sup>-1</sup> body weight per day of *Centella asiatica* fresh leaf extract for longer periods of time (i.e. 4 and 6 weeks). So, the constituents/active principles present in *Centella asiatica* fresh leaf extract have a neuronal dendritic growth stimulating property (Mohandas Rao *et al.*, 2006).

Another study assessed the effects of *Centella asiatica* plant materials of different genotypic origin; hexane, ethyl acetate and methanol extracts of *Centella asiatica*; and asiaticoside, a triterpenic compound

isolated from *Centella asiatica*. Various paradigms were used to assess the anxiolytic activity, including the elevated plus maze (EPM), open field, social interaction, locomotor activity, punished drinking and novel cage tests. The EPM test revealed that *Centella asiatica*, its methanol and ethyl acetate extracts as well as the pure asiaticoside, imparted anxiolytic activity (Wijeweera *et al.*, 2006).

The effect of *Centella asiatica* extract and powder in reducing oxidative stress in rats was evaluated in another study. Lipid peroxidation was monitored by measuring malonaldehyde (MDA) level in blood. Activities of free radical-scavenging enzymes (superoxide dismutase and catalase) were determined using  $H_2O_2$  decomposition and nitrobluetetrazolium reduction, respectively. Results revealed that *C. asiatica* extract and powder may ameliorate  $H_2O_2$ -induced oxidative stress by decreasing lipid peroxidation via alteration of the antioxidant defense system of the rats. (Hussin *et al.*, 2007)

It has also been reported that *Centella asiatica* supplementation is effective in reducing brain regional lipidperoxidation (LPO) and protein carbonyl (PCO) levels and in increasing anti oxidant status (Subathra *et al.*, 2005).

An alcoholic extract of *Centella asiatica* has been reported to be tranquillizing in rats, an activity that has been attributed to a triterpene, *Brahmoside*. The extract has also been shown to have sedative, antidepressant and potentially cholinomimetic activities *in vivo* (Sakina and Dandiya, 1990). Cognitive-enhancing effects were observed in rats following oral administration of an aqueous extract of *Centella asiatica* and this effect was associated with an antioxidant mechanism in the CNS (Kumar and Gupta, 2002).

*Centella asiatica* has been reported to accelerate nerve regeneration upon oral administration and contains multiple active fractions increasing neurite elongation *in vitro*. Axonal regeneration is important for functional recovery. *Centella asiatica* ethanolic extract elicited a marked increase in neurite outgrowth in human SH- SY5Y cells in presence of nerve growth factors. Greatest activity was found with a non- polar fraction (GKF4). (Soumyanath *et al.*, 2005). Treatment of *Centella asiatica* leaf extract during the growth spurt period enhanced hippocampal CA3 neuronal dendritic arborization in rats (Mohandas Rao *et al.*, 2006). An aqueous extract of *C. asiatica* leaf modulated dopamine, 5-HT and noradrenaline systems in rat brain and improved learning and memory processes *in vivo* (Nalini *et al.*, 1992).

Intracerebroventricular streptozotocin in rat has been likened to sporadic Alzheimer's Disease in humans and cognitive impairment is associated with free radical generation in this model. Aqueous extract of *Centella asiatica* is reported to be effective in preventing the cognitive deficits as well as oxidative stress caused by intracerebroventricular streptozotocin in rats (Veerendra Kumar and Gupta, 2003). The triterpene asiatic acid (found in *Centella asiatica*) and its derivatives have been shown to protect cortical neurons from glutamate-induced excitotoxicity *in vitro* (Lee *et al.*, 2000). Beneficial effect of *Centella asiatica* has been reported on cognitive functions and oxidative stress in rats (Gupta *et al.*, 2003). Additive anticonvulsant activity of *Centella asiatica*'s ethyl acetate fraction with some anti epileptic drugs has also been reported (Vattanajun *et al.* 2005). In another study, only the aqueous extract of whole plant (200mg/kg for 14 days) showed an improvement in learning and memory in both shuttle box and step through

paradigams. The findings indicated that the aqueous extract of *Centella asiatica* has cognitive enhancing effect and an antioxidant mechanism is involved in this. (Veerendra Kumar and Gupta, 2002).

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### Conclusion

In a nutshell, the present review is indicative of multiple useful clinical effects of *Centella asiatica*. However, the mechanism of action and possible toxicity needs to be further investigated in a large scale.

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