

Centella Asiatica: Bridging the Gap between Traditional Knowledge and Modern Science

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Abstract: *Centella asiatica* commonly known as Indian pennywort belong to family Apiaceae known as gotu kola. It is found in Southeast Asia and traditionally used as brain stimulating in ayurvedic medicine. Generally, *Centella asiatica* use in treating skin problem like wound healing, revitalized nerve and brain cell. It has potential antimicrobial, antioxidant, neuroprotective, anti-inflammatory, hepatoprotective, immunostimulant, cardio protective and other activities widely claimed in many reports. These review paper aims to cover up the pharmacological properties with their mechanism of action and traditional uses of *Centella asiatica* have been discussed to provide information on its multipurpose commercial values.

Keywords: *Centella asiatica*, Pharmacological properties, Traditional uses, Chemical constituents

1. Introduction

Herbal remedies are best option for treating the several diseases due to presence of many compounds responsible for their activity. One of the plant *Centella asiatica* L synonymes *Hydrocotyle asiatica* belongs to family Apiaceae commonly known as Gotu Kola. It grow in the tropical region of Asia.(1) *Centella asiatica* generally used for the treatment of skin diseases like skin lesions, scars, eczema and also improves small wounds, scratches, burns and as anti-inflammatory activity and also many studies suggested it is used as anti-inflammatory(2,3) , antipsoriatic (4), antiulcer (5,6), hepatoprotective (7), anticonvulsant(8), sedative (9) immunostimulant (10) , cardioprotective (11,12) antidiabetic (13) , cytotoxic and antitumor, antiviral, antibacterial insecticidal, antifungal, antioxidant and for lepra and venous deficiency treatments.(11) Besides its common use its also use as salad, as vegetables and blended as drinks and also used as nutraceuticals preparation thus it is an important commercial plants.(14)

The plant is known as following names: Thankunu (Bengali), Mandookaparni (Hindi), Pegaga (Malay), Kodagam (Malyalam), Gotukola (Sinhalese), Vallarai (Tamil), Bekaparanamau (Telugu) (15)

Morphology: *Centella asiatica* is a perennial creeper herbs and its height up to 15cm. The leaves of *centella asiatica* have long petioles, 2.6 cm long, 4-5cm wide crenate margins, glabrous on both side.

Flowers are umbel shape, each umbel consist of 3-4 pink or purple flowers. Flowers shows between the month of April to June. Fruits are schizocarp approx. 2 inches long, oblong, globular in shape and strongly thickened pericarp. The embryo of the seeds have pendulous which is laterally compressed.

Centella asiatica grow very well in sandy and clay soil rich with organic matter. Plant are generally found throughout the tropical and subtropical region which altitude upto 600-700m. Plant is growing swampy areas including India, South

east Asia, Sri Lanka, Pakistan, Parts of China and South Africa. Most of *Centella asiatica* grow in wet pan tropical region likes higher elevations such as rice paddies and also in rocky. (16,17)

Classification of the Plants

Chemical Constituents: The scientific studied suggest that many biochemical component have found in *Centella asiatica*. The chemical constituents of *Centella asiatica* plant have important medicinal and neuraceutical properties. It is known for the biologically active components of saponins and triterpenes. It is rich source of amino acids, phenols, carbohydrates. The active constituents of triterpenes are asiatic acid, asiaticoside, brahmie acid, brahminoside, brahmoside, centelloside, centic acid, cenellicacid, isothankuniside, madecassic acid, madecasoside and thankiniside. (18)

The saponin and their sapogenin is mainly responsible for the wound healing activity and vascular effect by stopping the production of collagen at the site of wound. The crude extract of *Centella asiatica* which containing glycosides isothankuniside and thankuniside suggested antifertility action (19)

Centella asiatica contains traces amount of alkaloids. The dried part of the plant contains Hydrocotylin which has been extracted by *Centella asiatica*. The plants also contain 38% volatile oils and fatty acids like glycerides, stearic acid, linoleic acid, palmitic acid, oleic acid. (20)

The plant is also contains tannins, inorganic acid, resin sugar and its total ash contains sodium, potassium, magnesium, phosphorus, sulohate, iron, calcium and chloride. (21, 22)

Pharmacological activity and their mechanism:

Anti-inflammatory activity:

Yun et al. suggested that their active constituents Asiatic acid and asiaticoside isolated from leaves showed the positive anti-inflammatory effect. Its inhibit the enzymes

cyclooxygenase 2, interleukin and cytokines tumour necrosis factors. Centella asiatica water extract its constituents asiaticoside have anti-inflammatory activity by inhibiting the NO synthesis and promote ulcer healing. (23)

The methanolic extract showed significant inhibition which was slightly lower than indomethacin. (24) The aqueous extract of Centella asiatica tested in acetic acid induced writhing resulted in significant antinociceptive and anti-inflammatory activity in both model. (24)

It is also suggested that the active constituents of madecacosside has anti rheumatoids activity. The mechanism was found to be that it reduced the serum level of anti CIIIgG and suppressed delayed type hypersensitivity. (25)

Antioxidant activity:

Zhimin et al suggested that Asiatic acid has cytoprotective effect against t-BHP induced cell damaged by suppressing cytotoxicity and generation of reactive oxygen species. Asiatic acid activates Nrf2 signal in HepG2 cell. Nrf2 activate variety of antioxidant gene by promoting transcription. (26).

It is also suggesting that methanolic extract of Centella asiatica prevent oxidative stress by increasing antioxidant enzyme in lymphoma bearing mice models against the oxidative stress. (27)

Centella asiatica known as high antioxidant activity which is comparable to activity of rosemary and sage, vitamin c and grape seed extract. (28)

Neuroprotective activity:

It was suggested that Centella asiatica leaves extract has neuroprotective activity in hippocampal region. It protect the hippocampal neuron from the degeneration by protect the neuron. It is responsible for the neuroprotection against the cell death. (29)

It was reported that it has neuroprotective effect on cognition and hippocampal region by promoting the dendritic arborization of hippocampal neurons. Centella asiatica fresh leaves extract enhanced the learning and memory abilities in rats. (30)

Khotimah et al also suggested that it maintain neural motility with increase the level of dopamine zebrafish model by induced rotenone. (31) Acute administration of Asiatic acid in male Sprague Dawley rats were observed learning and memory activity. (32)

Anti-ulcer activity:

The active constituents of Asiaticoside significantly inhibited the gastric ulceration induced by the cold and restraint stress. The reduction of gastric ulceration was dose dependent associated with increase in GABA level in the brain. (33)

The aqueous extract of Centella asiatica was found to be inhibit gastric lesion which was induced by the ethanol administration. It was concluded that reduced the effect of

free radical which damaged the gastric mucosal barrier, Centella asiatica strengthened this mucosal barrier. (34)

Fresh juice of Centella asiatica significantly protect against the ulcer by strengthening mucosal defensive factors. (35) Other studies revealed that gastric mucosa protected by the inhibition of leukocytes infiltration in gastric mucosal wall when pretreated with Centella asiatica extract in rats. (36)

Anticancer activity:

The extract of Centella asiatica leaves decreased the number of lungs tumour nodules induced by the benzo(a)pyrene. There was result that increases the phosphorylation of cyclic AMP response element binding protein in neuroblastoma cultured cell that expressed beta amyloid 1-42. Thus was preventing cell proliferation towards malignancy. (37), (38)

Xu et al suggested that extract of Centella asiatica inhibit the development of tumors by the direct action on DNA synthesis. (39) Immunomodulatory effect of Centella asiatica extract has chemopreventive and antiproliferative effect. (40)

Babykutti et al suggested that Centella asiatica extract showed that dose dependent inhibition of cell proliferation in breast cancer and MCF-7 cell. Author was found that a concentration dependent decrease in cell viability with different concentration in MCF-7 cell and in other cell lines such as HeLa, HepG2 and SW 480 did not find decrease in cell viability with different concentration. (41)

The methanolic extract of the aerial part of the plant showed antiproliferative effect in mouse fibrosarcoma cell, murine malonoma cell, human liver cancer cell and MK-1 cell in vitro and vivo tumor model system. (42), (43)

Cognitive function (Memory Enhancer):

Nalini et al suggested that Centella asiatica fresh leaves showed protective effect on learning and memory. It was revitalized the brain and nervous system and show significant effect on learning and memory by decreasing level of norepinephrine, 5HT and dopamine in the brain. (44)

The aqueous extract of Centella asiatica enhanced the cognitive and antioxidant properties when tested against streptozocin induced cognitive impairment and oxidative stress in rats. (45)

The aqueous, methanolic and chloroform extract increase the learning, memory and antioxidant property by decreasing the lipid peroxidation and surmounting antioxidant enzymes in brain. (46)

Wound Healing Activity:

The major constituents Asiatic acid, asiaticoside and, madecassic acid, of Centella asiatica facilitates wound healing by increasing collagen synthesis (47) (48)

Aqueous extract of Centella asiatica recover wound faster by increasing collagen synthesis and cellular proliferation and increase in tensile strength.

Asiaticosides increase the antioxidant level at initial stage of healing which is important contributory factor of its healing properties. Thus, the plant appears to be effective in treatment of wound healing disturbances. (49)

Cardioprotective Activity:

Pragada et al evaluated that alcoholic extract of *Centella asiatica* showed cardioprotective effect against ischemia reperfusion induced myocardial infarction. (50)

Antimicrobial and Antifungal Activity:

Antimicrobial activity of *Centella asiatica* plant was estimated by agar diffusion method. It is showed that zone inhibition of selected strained was measured against antibiotics ciprofloxacin. It showed that ethanolic extract of *Centella asiatica* has higher antimicrobial activity. (53)

Traditional Uses of *Centella asiatica*:

Centella asiatica traditionally used in crop in rubber and tree plantation. It is also used as summer drinks popularly known as thandayee. *Centella asiatica* generally eaten as green leafy vegetables in the form of salad. It can be also used as soup. In Srilanka, the leaves of *Centella asiatica* are used as "mallung" which is a traditional curry and in the porridge known as "kolakenda" to combat malnutrition extract of the *Centella asiatica* is also used in the production of food products, i.e. herbal noodles. In China, it is used in the form of cooling drink. (51) (52)

2. Conclusion

Centella asiatica is potential herbs which have a many pharmacological activity and widely accepted that plant have neuroprotective activities and helpful in brain development. Several research demonstrated the plant have many functional properties like wound healing activity, antioxidant activity, antidiabetic activity, antifungal, antiviral, cardio, neuro, skin activities with very low toxicity. *Centella asiatica* is potential herbal plant in many healthcare application

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