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Centella asiatica: A mini review of its medicinal properties and different uses

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Abstract

A useful plant for human medicine is *Centella asiatica* (L.). *Centella asiatica* (L.) is widely used in conventional medicine, including unani, ayurveda, and herbal treatments. It is an important medicinal herb used around the world that is perennial, creeping, and barely fragrant. It is found throughout the world's tropical and subtropical regions, including Bangladesh, India, China, Nepal, Madagascar, Sri Lanka, and Indonesia, and others. The herb is suggested for the treatment of a number of skin problems, including leprosy, lupus, varicose ulcers, eczema, psoriasis, diseases of the female genitourinary system, as well as for reducing anxiety and enhancing cognition. Science has validated the bioactive components and promoted several of its uses. In order to provide a easy summary of this plant, We have assessed the ancient literature that is available in search of the medicinal value of *C. asiatica*. We tried to compare ancient literature findings with our practical experience and insights in the context of Bangladesh.

Keywords: *Centella asiatica*; Therapeutic; Phytoconstituents; Ayurveda

1. Introduction

The plant is a member of the Umbelliferae/Apiaceae family and is known as 'Gotu Kola' in China and 'Thankuni' in Bangladesh.

The plant has been used as a vegetable for a very long time in China, Southeast Asia, India, Sri Lanka, Oceania, and Africa. It has a long history of use in Southeast Asia for a number of ailments, including skin conditions, rheumatism, inflammation, syphilis, mental illness, epilepsy, hysteria, dehydration, and diarrhoea[1-2]. Indian systems of medicine employ *Centella asiatica* (Gotu Kola) for memory improvement, the treatment of skin conditions, and the management of nervous system illnesses[3]. *Centella asiatica* (Linn.) has been used as a treatment for mild and chronic ailments for thousands of years, relying on experience and folk medicines, and they continue to get significant attention for this reason. The world has recently placed more emphasis on plant study, and a substantial body of evidence has accumulated to demonstrate the enormous potential of medicinal plants utilised in diverse traditional systems of medicine. For thousands of years, the medicinal herb *Centella asiatica* L. has been utilised in the Indian subcontinent, China, Sri Lanka, Nepal, and Madagascar. The Indian Pharmacopoeia suggested it for the treatment of many skin problems, including leprosy, lupus, varicose ulcers, eczema, psoriasis, diarrhoea, fever, amenorrhoea, and diseases of the female genitourinary system, in addition to wound healing[4]. The results of these research are still unsatisfactory despite the enormous number of studies that have been reported over the past few decades on the evaluation of biologically active components and their mechanisms of action. It is essential for screening medicinal plants in order to discover novel chemicals with potential for therapeutic use[5]. However, due to vast, unrestricted extraction, inadequate cultivation, and insufficient measures to replace it, the natural population of this plant species has been significantly reduced. Additionally, the International Union for Conservation of Nature and Natural Resources (IUCN) has officially designated it as a threatened plant species[6].

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Scientific classification of *Centella asiatica*, source: wikipedia

- Kingdom: Plantae.
- Division: Angiospermae
- Class: Dicotyledoneae
- Order: Umbelliferae
- Family: Apiaceae
- Genus: *Centella*
- Species: *asiatica* Linn.

2. Botanical description

Throughout India, *Centella asiatica* (CA), a clonal, perennial herbaceous creeper from the family Umbelliferae (Apiaceae), grows in damp areas up to an elevation of 1800 metres. It grows in swampy places throughout the majority of tropical and subtropical nations, including sections of India, Pakistan, Sri Lanka, Madagascar, South Africa, the South Pacific, and Eastern Europe. In most tropical or wet pantropical regions, such as rice fields, as well as in rocky, higher elevations, about 20 species related to CA grow [7]. It features tiny green leaves in the shape of a fan, white, light purple-to-pink, or white flowers, and bears tiny oval fruits (fig. 1). The entire plant is employed as a medicine [8]. It is a plant that grows in near water and has no flavour with slightly bitter taste.

It is frequently used as a blood purifier, to treat high blood pressure, to improve memory, and to lengthen life. One of the key herbs in Ayurveda for reviving the nerves and brain cells is CA. Eastern healers used CA to treat emotional diseases like depression that were believed to have a physical cause [9-10]. Due to its numerous applications in the treatment of illnesses, the plant has attracted the attention of scientific organizations substantially in recent years.



Figure 1 *Centella asiatica* herbs

3. Phytoconstituents

The biochemical compositions of *Centella asiatica* has been widely studied and researched.

- Triterpenoids
- Volatile oil and Fatty acids
- Alkaloids
- Glycosides
- Flavonoids
- Others
- Vitamin B, C, G and some amino acids etc.

It also contains volatile fatty acid which consists of steric, palmitic, oleic, lignoceric, linolenic and linoleic acids[11]. Triterpenoids Include centellose, asiatic, centellic, and madecassic acids, as well as thankuniside, madecossoside, centelloside, and isothankunic acid[12]. Asiaticoside and madecossoside predominated in the leaves with less in roots[13]. From the dried plants, an alkaloid called hydrocotylin ($C_{22}H_{33}NO_8$) has been extracted[14]. From the plant components, asiaticoside, madecossoside, and centelloside have been separated. With the exception of centellic acid, these glycosides are all present in the plant in their free forms. Upon hydrolysis, these glycosides produce the triterpene acids asiatic acid, madagascar acid, and centellic acid[15]. The leaves have been used to isolate flavanoids, including 3-glucosylquercetin, 3-glucosylkaemferol, and 7-glucosylkaemferol. According to reports, the plant contains amino acids such as aspartic acid, glycine, glutamic acid, -alanine, and phenylalanine as well as tannins, sugars, inorganic acids, and resin[16].

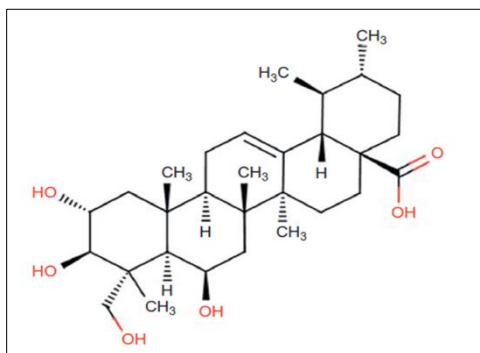


Figure 2 Asiatic Acid

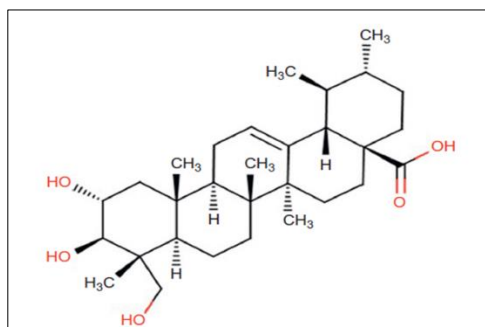


Figure 3 Madecassic Acid

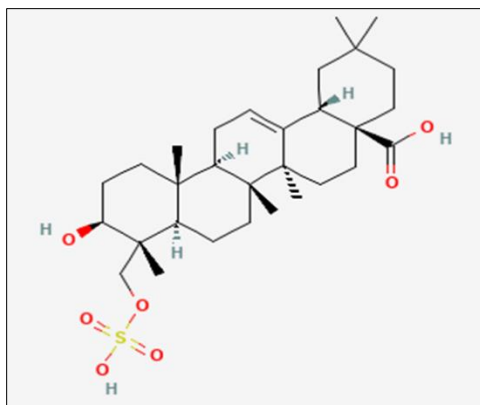


Figure 4 Triterpene

4. Therapeutic Characteristics

4.1. Memory boosting

The herb's aqueous extract significantly improved learning and memory while lowering brain levels of norepinephrine, dopamine, and 5-HT and its metabolites[17]. Brahmic acid, isobrahmic acid, brahminoside, and brahmside are all present in *Centella asiatica*. It possesses sedative, anti-convulsant, and psychoactive effects. Additionally, it helps with anxiety, mental illnesses, and dementia. Children with learning disabilities benefit from Mentat, a polyherbal formulation in which all the herbs work in concert to improve memory, attention, and concentration.

4.2. Cytotoxic and antitumor activity

Inducing apoptosis in solid and Ehrlich Ascites tumours via oral treatment of *Centella asiatica*'s crude extract and its partially purified components extended the lives of mice bearing these tumours. Skin cancer was found to be resistant to the anticancer effects of Asiatic acid[18-19].

4.3. Wound healing capacity

The *Centella asiatica* extracts (CAE), which have been used for wound healing in the past, are now more strongly supported by research [20]. An aqueous CA Extract in different formulations (ointment, cream, and gel) was applied to open wounds in rats three times a day for 24 days. This led to increased cellular proliferation and collagen synthesis, as evidenced by an increase in collagen content and tensile strength, at the wound site [21]. Topical administrations of a 0.2% solution of asiaticoside in guinea pig punch wounds resulted in a 56% rise in hydroxyproline, a 57% increase in tensile strength, a higher collagen content, and improved epithelization. Topical treatment of 0.4% asiaticoside solution over punch wounds in streptozotocin diabetic rats, where healing is slowed, improved hydroxyproline content, tensile strength, collagen content, and epithelization, speeding up the healing process. Asiaticoside proved effective in the guinea pig punch wound model when administered orally at a dose of 1 mg/kg. At a concentration of 40 /disc, it induced angiogenesis in the chick chorioallantoic membrane model. An alcoholic extract of CA's effects on oral and topical administration on rats' cutaneous wound healing were assessed in one study [22].

4.4. Immunomodulating properties

Triterpenoid Saponins and methanol extracts shown preliminary evidence of immunomodulatory effects, while pectin extracted from *Centella asiatica* shown immunostimulating activity [23-24].

4.5. Anti-inflammatory activity

Extract of *Centella* exerted anti-inflammatory effects by reduction of acute radiation reaction in rats. *Centella asiatica* water extract and its active constituent asiaticoside have an anti-inflammatory property that is brought about by inhibition of NO synthesis and thus facilitate ulcer healing [25]. Rats' paw edoema caused by prostaglandin E2 induced anti-inflammatory action in *Centella asiatica* crude extract. The crude extract may contain bioactive terpene acids such asiatic acid and madecassic acid, which could be responsible for the anti-inflammatory effects [26].

4.6. Anxiolytic characteristics

Researchers tested the effects of *Centella asiatica* on rats' anxiety levels in the elevated plus maze, open field test, social interaction test, locomotor activity test, Vogel test, and novel environment test. They discovered that the plant's extracts, which are high in triterpenes, may have anxiolytic properties. Asiaticoside is the most active and prominent triterpene, even if other active substances may contribute to significant plant activity that is affected by or connected to asiaticoside [27].

4.7. Antiulcerant properties

Aqueous extract of CA was found to be useful in preventing stomach lesions brought on by the administration of ethanol in a laboratory trial that was published[28]. Studies on animals demonstrated that CA extracts prevented rat stomach ulcers brought on by cold and restraint stress. The H2-antagonist famotidine and the antiepileptic or antiseizure drug sodium valproate were contrasted with the antiulcer activity. With the exception of famotidine's antiulcer activity, both the medicines and the herb extract reduced stomach ulceration in a dose-dependent manner that was reversible with the help of the specific GABAA antagonist bicucullin methiodide[29]. According to one study, the anti-inflammatory properties of CA and its constituent asiaticosides are caused by the suppression of nitric oxide (NO), which promotes ulcer healing [30].

4.8. Hepatoprotective activity

Interleukin-1, MCP-1, and tumour necrosis factor alpha concentrations in the livers of diabetic control rats given deionized water were decreased to 68%, 75%, and 63% of normal control rats given deionized water values, respectively. This study evaluated the effect of methanolic extract of CA in Type 2 diabetes mellitus[31]. At C2, C3, C23, and C28, asiatic acid's functional group underwent modifications. Compound 9 demonstrated strong hepatoprotective effects against hepatotoxicity caused by GalN (66.4% protection at 50 M) and moderate hepatoprotective activity against hepatotoxicity caused by CCl4 (20.7% protection at 50 M)[32]. Asiatic acid prevents liver damage by beginning to suppress TGF-beta/Smad-assisted fibrogenesis in a Smad7-dependent manner. Therefore, traditionally utilised botanicals to treat liver failure might be a source of new hepatoprotective chemicals that could be developed as pharmacological entities[33].

4.9. Antibacterial property

According to a study, essential oil extract shown antibacterial activities against Gram-positive (*Bacillus subtilis* and *S. aureus*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, and *Shigella sonnei*) bacteria with MIC values ranging from 1.25 to 0.039 mg/ml[34]. In order to investigate the antibacterial activity in *C. asiatica* under both normal and osmotic stress conditions, *Bacillus cereus* and *Listeria monocytogenes* 10403S were chosen. Under conditions of osmotic stress, antibacterial activity was twice increased in extracts of 95% ethanol. *C. asiatica* was found to have a 16 l/ml MIC against *B. cereus* and an 8 l/ml MIC against *L. monocytogenes*10403S[35].

4.10. Antifungal activity

When *Aspergillus flavus* was exposed to an ethanolic extract of *Centella asiatica*, *Penicillium citrinum* had the greatest antimold action (% mycelial inhibition = 26.3 mm)[36]. An average 5 mm zone of inhibition was seen against *Candida albicans*, compared to a 20 mm inhibition with conventional miconazole nitrate[37].

4.11. Antidiabetic property

In a tolerance test, methanolic and ethanolic extracts significantly reduced blood glucose levels to normal glucose levels and proved the plant's anti-hyperglycemic efficacy in type II diabetic rats[38].

5. Precautions and safety

C. asiatica is not hazardous when used as recommended. Although they are uncommon, side effects could include skin allergies, burning sensations (when used externally), headaches, nausea, vomiting, dizziness, and excessive sleepiness. These effects are more likely to happen when using high quantities of the herb. There is a small chance that the fresh plant will cause skin discomfort. Using topical treatments, there have been a few reports of contact dermatitis[39]. The research does not advise using CA for longer than six weeks. People who have taken the herb for a prolonged period of time (up to 6 weeks) should wait two weeks before taking it once more. Experimental animals tolerated the standardised CA extracts and asiaticoside well, especially when administered orally. Asiaticoside did not exhibit any hazardous effects when administered orally up to a level of 1 mg/kg, while mice and rabbits were found to exhibit toxic effects at doses of 40–50 mg/kg when administered intramuscularly.

6. General uses in Bangladesh and India

Few decades ago village people uses *Centella asiatica* as talisman and they also used it for the remedy of dysentery. Some people used it to relieve from gastric problem and for increasing appetite.

Some commercial products made from *Centella asiatica*:

- Gertiforte by The Himalaya Drug Company, Bangalore
- Menosan by The Himalaya Drug Company, Bangalore
- Nourishing Skin Cream by The Himalaya Drug Company, Bangalore
- Centurin by Hamdard Laboratories (Waqf) Bangladesh

7. Conclusion

C. asiatica is a promising herb with numerous medical uses. It is commonly acknowledged that plants have neuroprotective properties and are beneficial for brain development. According to the text described above, plants have

demonstrated less toxicity and higher efficacy in clinical treatment with notable activities like anticancer, antibacterial, antifungal, anti-inflammation, neuroprotection, antioxidant, wound healing, and antidepressant. Further in-depth study seems essential given the therapeutic potential of this plant in terms of its efficacy and adaptability. It is necessary to find all the chemical composition of this utile herb. Ethnopharmacological study should be carried out more and more to demonstrate the therapeutic effectiveness of its phytochemicals. A rising variety of herbal products, including CA, are available on the market, which may increase the risk of side effects from using them incorrectly or without a doctor's supervision. Following clinical investigations to determine their safe application for people, more research is required to establish their functions as described in ancient writings.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest regarding this paper.

Availability of data and materials

The data and materials used to support the findings of this study are publicly available.

Author contribution

All author contributed significantly to design and development of this work.

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