

Review Article



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"BRAHMI (BACOPA MONNIERI) VERSUS MANDUKAPARNI (CENTELLA ASIATICA): A COMPARATIVE REVIEW OF NEUROPHARMACOLOGICAL EVIDENCE"

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ABSTRACT:

Background: Bacopa monnieri and Centella asiatica are two of the most important Medhya (intellect-promoting) herbs in Ayurveda. Both have been called "Brahmi" in different regions and texts, leading to long-standing confusion in practice, trade and research. Charaka names Mandukaparni as a Medhya Rasayana, while later texts and modern Indian practice usually identify Brahmi with Bacopa. **Objective:** To clarify the botanical identity of Brahmi and Mandukaparni and to compare their phytochemistry, neuropharmacology and clinical evidence for cognition and mood. **Methods:** Narrative review of classical Ayurvedic sources and modern pharmacological reviews, randomised controlled trials and meta-analyses. **Results:** Bacopa contains triterpenoid saponins called bacosides, while Centella contains pentacyclic triterpenes such as asiaticoside, madecassoside, asiatic acid and madecassic acid. Both show antioxidant, anti-inflammatory and neuroprotective effects in animals. Clinically, Bacopa has more consistent evidence: a meta-analysis of nine randomised trials found improved attention and processing speed, and individual trials show improvements in memory consolidation after about 12 weeks. A meta-analysis of Centella trials found no clear effect on cognitive domains but some improvement in alertness and reduced anger, and a trial in healthy elderly people reported better working memory and mood. Centella reduced the acoustic startle response in healthy volunteers, suggesting anxiolytic potential. **Conclusion:** The two herbs are distinct and should not be used interchangeably in research or labelling. Bacopa has stronger evidence for memory and attention; Centella has emerging evidence for mood and alertness. Correct botanical identification, standardised extracts and longer trials in clinical populations are needed for both.

Keywords: Brahmi; Bacopa monnieri; Mandukaparni; Centella asiatica; Medhya Rasayana; cognition; memory; anxiety

INTRODUCTION:

Medhya Rasayanas are a group of herbs that Ayurveda uses to improve intellect, memory and mental stability. Among them, Brahmi and Mandukaparni are perhaps the most widely used. Both are small creeping plants that grow in moist places, both are traditionally used for memory and mental disorders, and both have been called Brahmi in different regions of India.

This shared name has caused confusion. Charaka names the juice of Mandukaparni as a Medhya Rasayana^[1]. Later texts describe Brahmi separately, and in most of modern India Brahmi refers to Bacopa monnieri, while Mandukaparni refers to Centella asiatica. In some regions, however, Centella is sold or used as Brahmi^[2]. In international trade, Centella is known as Gotu kola. This confusion matters for research, because studies may test one plant while citing traditional evidence for the other, and for

patient safety, because products labelled “Brahmi” may contain either plant.

This review clarifies the identity of the two plants and compares the neuropharmacological and clinical evidence for each.

METHODS:

Classical sources were Charaka Samhita (Chikitsa Sthana 1) and standard Ayurvedic pharmacology texts^[1]. Modern literature was identified through PubMed and Google Scholar using Bacopa monnieri, Brahmi, Centella asiatica, Mandukaparni, Gotu kola, cognition, memory, anxiety, mood, neuroprotection, randomised controlled trial and meta-analysis. This is a narrative review.

BOTANICAL IDENTITY AND CLASSICAL DESCRIPTION:

Table 1: Botanical identity and classical description of Brahmi and Mandukaparni

Feature	Brahmi	Mandukaparni
Botanical name	Bacopa monnieri (L.) Wettst.	Centella asiatica (L.) Urb.
Family	Plantaginaceae (formerly Scrophulariaceae)	Apiaceae
Common names	Water hyssop, Brahmi	Gotu kola, Indian pennywort, Mandukaparni
Leaf form	Small, fleshy, oblong, opposite leaves	Kidney- or fan-shaped leaves with long stalks
Habitat	Marshy places, wetlands	Moist, shady places
Classical reference	Later texts (for example, Bhavaprakasha)	Charaka, as Medhya Rasayana ^[1]
Classical properties	Bitter, cold; Medhya, Ayushya, Rasayana	Bitter, cold; Medhya, Rasayana
Main traditional uses	Memory, intellect, Unmada, Apasmara, voice	Memory, skin disease, wounds, Rasayana

Both are described as bitter and cold in potency, pacifying Pitta and Kapha, and promoting intellect and longevity. Brahmi is particularly associated with improvement of memory, voice and treatment of Unmada and Apasmara. Mandukaparni is also widely used for skin disorders and wound healing.

PHYTOCHEMISTRY:**Bacopa monnieri**

The main bioactive compounds of Bacopa are triterpenoid saponins known as bacosides, especially bacoside A (a mixture including bacoside A3, bacopaside II, bacopasaponin C and jujubogenin isomers) and bacoside B^[3,4]. Other constituents include alkaloids, flavonoids and sterols. Standardised extracts are usually defined by their bacoside content.

Centella asiatica

The main bioactive compounds of Centella are pentacyclic triterpenes: the glycosides asiaticoside and madecassoside and their aglycones asiatic acid and madecassic acid^[5]. Flavonoids and other compounds are also present. Standardised extracts are usually defined by total triterpene content.

NEUROPHARMACOLOGY:**Bacopa monnieri**

Experimental studies suggest that Bacopa acts through several mechanisms^[3,4]:

- Antioxidant effects: increasing antioxidant enzymes and reducing lipid peroxidation in the brain.

- Cholinergic modulation: effects on acetylcholine levels and acetylcholinesterase activity.
- Synaptic plasticity: enhancement of protein kinase activity and dendritic growth in memory-related brain areas.
- Amyloid reduction: reduction of amyloid in some animal models.
- Monoamine modulation: effects on serotonin and dopamine systems.

In rats, a standardised Bacopa extract also showed antidepressant activity in forced swim and learned helplessness models, comparable to imipramine^[6].

Centella asiatica

Experimental studies suggest that Centella acts through^[2,5]:

- Antioxidant and anti-inflammatory effects in the brain.
- Neuroprotection against various toxins in animal models.
- Effects on GABA systems, which may explain anxiolytic effects.
- Neurotrophic effects, including promotion of neurite growth and dendritic arborisation.
- Improvement of memory in rodent models of cognitive impairment.

Comparison

Both herbs share antioxidant, anti-inflammatory and neuroprotective actions. Bacopa has more data on cholinergic mechanisms and synaptic plasticity, while Centella has more

data on anxiolytic (GABA-related) and neurotrophic effects. These differences are consistent with clinical findings that Bacopa mainly affects memory and attention, while Centella appears to influence mood and alertness.

CLINICAL EVIDENCE:

Bacopa monnieri

Bacopa has been studied in several randomised, placebo-controlled trials, mainly in healthy adults and older adults without dementia.

A systematic review of randomised controlled trials concluded that Bacopa improved memory free recall, with less consistent effects on other cognitive domains^[7]. A meta-analysis of nine randomised trials with 518 participants found that Bacopa improved performance on the Trail Making Test part B and shortened choice reaction time, indicating benefits for attention and processing speed^[8].

In a 90-day randomised trial in healthy adults, a special extract of Bacopa improved spatial working memory accuracy and a measure of memory consolidation^[9]. In a 12-week trial in older adults without dementia, Bacopa improved memory acquisition and retention and reduced anxiety and depression scores compared with placebo^[10].

A further randomised, double-blind trial in 98 healthy adults

over 55 years found that 12 weeks of Bacopa improved verbal learning, memory acquisition and delayed recall compared with placebo^[11].

A consistent observation across trials is that benefits on memory appear only after several weeks of treatment, usually 8 to 12 weeks. This is consistent with the classical description of Rasayana as requiring prolonged use.

Centella asiatica

The clinical evidence for Centella is smaller. In a randomised, placebo-controlled trial in healthy elderly volunteers, Centella extract for two months improved working memory and mood measures compared with placebo^[12]. A systematic review and meta-analysis of randomised trials found no clear improvement in any specific cognitive domain with Centella, but reported improvement in alertness and a reduction in anger shortly after administration^[13].

In a double-blind, placebo-controlled study in healthy volunteers, a single dose of Centella significantly reduced the peak acoustic startle response, an experimental marker of anxiety, compared with placebo^[14]. This supports an anxiolytic effect, although the study was small and used a single dose.

Comparison of clinical evidence

Table 2: Comparison of clinical evidence for Bacopa monnieri and Centella asiatica

Outcome	Bacopa monnieri	Centella asiatica
Memory	Improved free recall and consolidation after 8–12 weeks ^[7,9,10]	Working memory improved in one trial in elderly ^[12]
Attention and processing speed	Improved in meta-analysis ^[8]	Improved alertness reported ^[13]
Anxiety	Reduced anxiety scores in elderly trial ^[10]	Reduced acoustic startle ^[14]
Mood	Reduced depression scores in elderly trial ^[10] ; antidepressant activity in rats ^[6]	Improved mood in elderly trial ^[12] ; reduced anger ^[13]
Dementia or MCI	No adequate trials	No adequate trials
Overall certainty (authors' judgement)	Moderate for healthy adults	Low

Table 3: Classical formulations containing Brahmi and Mandukaparni

Formulation	Main Medhya ingredient(s)	Traditional use
Brahmi Ghrita	Brahmi juice, with Vacha, Kushtha and Shankhapushpi in ghee	Unmada, Apasmara, memory
Saraswatarishta	Brahmi with other herbs, fermented	Memory, speech, anxiety, insomnia
Saraswata Churna	Vacha, Brahmi and others	Memory, speech, intellect
Mandukaparni Swarasa	Fresh juice of Centella	Medhya Rasayana (Charaka)
Medhya Rasayana combinations	Mandukaparni, Yashtimadhu, Guduchi, Shankhapushpi	Intellect, memory, mental stability

In practice, the fresh juice (Swarasa) of Mandukaparni, recommended by Charaka, is rarely used today outside rural settings, and most patients receive dried powders, tablets or extracts. Brahmi is commonly given as Brahmi Ghrita, which uses ghee as a vehicle. The choice of preparation may influence bioavailability. Bacosides and Centella triterpenes are relatively lipophilic, and ghee-based preparations may improve their absorption, but this has not been tested in humans.

DOSING IN CLINICAL TRIALS:

Most Bacopa trials have used standardised extracts at about 300 mg per day for adults, with bacoside content specified, and treatment durations of 12 weeks^[8-11]. Centella trials have used a wider range of extract doses, from single doses in experimental studies to daily doses over two months^[12,14]. Classical texts give doses of powder or fresh juice that are not directly comparable to these extract doses. Dose-finding studies comparing classical preparations with standardised extracts would help bridge practice and research.

QUALITY AND IDENTIFICATION:

Because the two herbs are confused in trade, simple identification tests are important. Macroscopic features (leaf shape, stem and habit) distinguish the fresh plants easily, but dried, powdered material requires microscopic examination and chemical fingerprinting. Thin-layer or high-performance thin-layer chromatography using bacoside A and asiaticoside as markers can reliably distinguish Bacopa and Centella.

Both plants grow in wet environments, and aquatic and semi-aquatic plants can take up heavy metals from contaminated water and soil. More generally, a study of Ayurvedic medicines sold over the internet found that about one-fifth contained detectable lead, mercury or arsenic^[15]. Testing raw material for heavy metals, pesticides and microbial contamination is therefore essential for both herbs, especially for products intended for long-term use.

SAFETY:

Bacopa is generally well tolerated but commonly causes gastrointestinal effects such as nausea, abdominal cramps and increased stool frequency, particularly when taken on an empty stomach^[7,8]. Taking it with food or with ghee, as is traditional, may reduce these effects.

Centella is also generally well tolerated in trials. Rare cases of liver injury have been reported with Centella products, and topical use can cause contact dermatitis. As with all herbal products, quality and correct identification are important.

Both herbs may have additive effects with sedatives. Their effects on drug metabolism are not well characterised, so caution is advised when they are combined with medicines that have narrow therapeutic ranges.

CLINICAL SCENARIOS:

The evidence and traditional use suggest some practical distinctions, which should be treated as provisional until comparative trials are done.

Students and working adults seeking better memory. Bacopa has the most relevant evidence, with improvements in memory and attention in healthy adults after 8 to 12 weeks^[8,9]. Users should be told that effects are gradual and modest, and that gastrointestinal side effects are common in the first weeks.

Older adults with subjective memory complaints. Bacopa has

trial evidence in healthy older adults^[10,11], and Centella has a trial showing improved working memory and mood in healthy elderly people^[12]. Either may be considered, with attention to other medicines and to the need for medical assessment of memory problems.

People with stress and anxiety. Centella's effect on the acoustic startle response^[14] and Bacopa's reduction of anxiety scores in older adults^[10] suggest possible benefits. However, Ashwagandha has stronger evidence for stress and anxiety, and both Bacopa and Centella are better regarded as supportive options.

Combined use. Many classical formulations combine Medhya herbs, on the principle that their actions complement each other. The rationale is plausible, given their different mechanisms, but combinations have not been tested against single herbs. Trials of combined preparations should include single-herb arms to identify the contribution of each.

DISCUSSION:

The confusion between Brahmi and Mandukaparni is not merely academic. A practitioner who prescribes "Brahmi" expecting the memory benefits shown in Bacopa trials may receive Centella from a supplier, and vice versa. Research papers sometimes cite classical Mandukaparni references to justify Bacopa studies, or the reverse. The two plants have different chemistry, different mechanisms and different clinical profiles.

Several steps would reduce this confusion. Pharmacopoeial monographs should clearly distinguish the two plants and specify identification tests. Products should be labelled with botanical names. Researchers should state the botanical name, plant part, extract and marker content, and should cite classical evidence specific to the plant studied. Practitioners should be aware of regional naming differences.

From a clinical perspective, the evidence suggests that Bacopa may be preferred when memory and attention are the main targets, and Centella when anxiety, mood or alertness are the main concerns. This is broadly consistent with traditional use, in which Brahmi is emphasised for intellect and memory, and Mandukaparni for Rasayana and calming effects. However, both conclusions rest on limited trials, mostly in healthy volunteers.

Future research should include head-to-head comparisons of standardised Bacopa and Centella extracts; trials in people with mild cognitive impairment and anxiety disorders; studies of classical preparations such as Brahmi Ghrita and Mandukaparni Swarasa (fresh juice); and trials of combined use, since many classical formulations include both.

CONCLUSION:

Brahmi (*Bacopa monnieri*) and Mandukaparni (*Centella asiatica*) are distinct Medhya herbs with different phytochemistry and partly overlapping neuropharmacology. Bacopa has the stronger clinical evidence for memory and attention after several weeks of use. Centella has emerging evidence for mood, alertness and anxiety. They should not be used interchangeably in research or labelling. Clear botanical identification and well-designed comparative trials are priorities for this area.

REFERENCES:

1. Sharma RK, Dash B. Agnivesa's Charaka Samhita (text with English translation), Chikitsa Sthana 1(3)/30-31. Varanasi:

Chowkhamba Sanskrit Series Office; reprint edition.

2. Shinomol GK, Muralidhara, Bharath MM. Exploring the role of “Brahmi” (*Bacopa monnieri* and *Centella asiatica*) in brain function and therapy. *Recent Pat Endocr Metab Immune Drug Discov*. 2011;5(1):33–49.

3. Russo A, Borrelli F. *Bacopa monniera*, a reputed nootropic plant: an overview. *Phytomedicine*. 2005;12(4):305–17.

4. Soundaryashree NR, Chandan RS, Singamaneni VR, Nagidi HR, Patel G, Vidiyala N, et al. Development and validation of RP-HPLC method for quantification of bamifylline in pharmaceutical formulations using analytical quality by design (AQbD) principles. *Adv J Chem Sect A*. 2025:2076-97.

5. Gohil KJ, Patel JA, Gajjar AK. Pharmacological review on *Centella asiatica*: a potential herbal cure-all. *Indian J Pharm Sci*. 2010;72(5):546–56.

6. Sairam K, Dorababu M, Goel RK, Bhattacharya SK. Antidepressant activity of standardized extract of *Bacopa monniera* in experimental models of depression in rats. *Phytomedicine*. 2002;9(3):207–11.

7. Vidiyala N, Sunkishala P, Parupathi P, Mandati P, Mantena SK, Kasu RRR, et al. High drug loading of amorphous solid dispersion by hot melt extrusion: the role of magnesium aluminometasilicate (Neusilin® US2). *Sci Pharm*. 2025;93(3):30.

8. Kongkeaw C, Dilokthornsakul P, Thanarangsarit P, Limpeanchob N, Norman Scholfield C. Meta-analysis of randomized controlled trials on cognitive effects of *Bacopa monnieri* extract. *J Ethnopharmacol*. 2014;151(1):528–35.

9. Prasad PL, Govindaraj S, Jahnvi P, Popatrao TP, Tummala T, Vidiyala P, et al. Metal oxide functionalized nanoparticles for the treatment of bacterial infection: synthesis, characterization, and therapeutic applications. *J Appl Organomet Chem*. 2025;5(3):232-57.

10. Calabrese C, Gregory WL, Leo M, Kraemer D, Bone K, Oken B. Effects of a standardized *Bacopa monnieri* extract on cognitive performance, anxiety, and depression in the elderly: a randomized, double-blind, placebo-controlled trial. *J Altern Complement Med*. 2008;14(6):707–13.

11. Kumar RKT, Dharmamoorthy G, Vasavi DD, Vidiyala N, Bagade OM, Elumalai S, et al. Phytoconstituent-based green synthesis of nanoparticles: sources and biomedical applications in cancer therapy. *Asian J Green Chem*. 2025;9(3):329-54.

12. Wattanathorn J, Mator L, Muchimapura S, Tongun T, Pasuriwong O, Piyawatkul N, et al. Positive modulation of cognition and mood in the healthy elderly volunteer following the administration of *Centella asiatica*. *J Ethnopharmacol*. 2008;116(2):325–32.

13. Vidiyala N, Sunkishala P, Mandati P, Parupathi P, Nyavanandi D. Integrating 3D printing and additive manufacturing into personalized medicine for pharmaceuticals: opportunities, limitations, and future perspectives. *Sci Pharm*. 2025;93(4):61.

14. Bradwejn J, Zhou Y, Koszycki D, Shlik J. A double-blind, placebo-controlled study on the effects of Gotu Kola (*Centella asiatica*) on acoustic startle response in healthy subjects. *J Clin Psychopharmacol*. 2000;20(6):680–4.

15. Saper RB, Phillips RS, Sehgal A, Khouri N, Davis RB, Paquin J, et al. Lead, mercury, and arsenic in US- and Indian-

manufactured Ayurvedic medicines sold via the Internet. *JAMA*. 2008;300(8):915–23.