

Clinical Evaluation of Brahmi in Cognitive Decline

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ABSTRACT

Brahmi (Bacopa monnieri) is the cornerstone Medhya Rasayana herb in the classical Ayurvedic cognitive repertoire, used for centuries for memory support, attention enhancement, and broadly the clinical territory modern medicine labels cognitive decline. Modern clinical evaluation of Brahmi has matured substantially over the past two decades, with standardised extracts, controlled trials across multiple cognitive populations, and a growing systematic review literature. Brahmi now sits alongside Ginkgo biloba as one of the most extensively clinically characterised botanical cognitive interventions, and it increasingly deserves to be taken seriously in European integrative neurology and integrative-memory clinics. This review covers 54 primary clinical studies published between 2005 and 2021 evaluating Brahmi in cognitive-relevant indications, grouped under five clinical evaluation frames: B1 (healthy adults and cognitive enhancement), B2 (mild cognitive impairment), B3 (age-related cognitive decline without formal MCI diagnosis), B4 (neurodegenerative disease including Alzheimer's-type dementia and Parkinson's disease cognitive impairment), and B5 (integrated multi-herb Medhya Rasayana protocols). Each frame is scored with the Brahmi Cognitive Performance Index (BCPI). Mild cognitive impairment (B2) produced the strongest clinical signal at BCPI 0.844, followed by age-related cognitive decline (B3) at 0.828 and healthy-adult cognitive enhancement (B1) at 0.806. Neurodegenerative disease (B4) scored lowest at 0.652, with the evidence supporting adjunctive rather than primary therapeutic use in this population.

Keywords: Bacopa monnieri; Brahmi; Medhya Rasayana; cognitive decline; mild cognitive impairment; nootropic; bacosides; memory enhancement; neuroprotection; age-related cognition; Alzheimer's adjunctive; BCPI

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1. Introduction

1.1 Brahmi as the Central Medhya Rasayana Herb

Brahmi (*Bacopa monnieri*) has the longest and most carefully developed clinical evidence base of any single Ayurvedic herb for cognitive indications. Classical Ayurvedic texts place it at the centre of the Medhya Rasayana category, the group of herbs specifically indicated for cognitive support and enhancement. Modern pharmacological investigation has identified bacosides A and B as the principal bioactive saponin glycosides responsible for the cognitive effects, with well-characterised mechanistic contributions including cholinergic enhancement, antioxidant activity in the central nervous system, hippocampal dendritic arborisation promotion, and modulation of beta-amyloid and tau pathways relevant to age-related cognitive decline. The pharmacology is coherent and the clinical trial base is substantial.

1.2 Clinical Evaluation Question and Study Objectives

The clinical evaluation question for Brahmi in 2022 is no longer whether it has cognitive effects. It does. The question is which cognitive populations it helps most, which cognitive domains respond most reliably, how its effect size compares to established pharmacological options in each population, and what role it should play in European integrative neurology and memory-clinic practice. This review organises the 2005-2021 clinical evidence along five cognitive-population frames, applies a structured scoring rubric, and examines which applications have the strongest evidence for European clinical deployment. Particular attention is given to the mild cognitive impairment and age-related cognitive decline populations because these are where the effect-size advantage of Brahmi is most clinically useful and where European memory-clinic patients most often seek integrative options. The paper follows the standard six-part structure.

2. Literature Review

2.1 Healthy-Adult Cognitive Enhancement Evidence Base

The healthy-adult cognitive enhancement frame (B1) has the oldest and most extensive evidence base. Stough et al. (2001) reported the landmark double-blind placebo-controlled trial of standardised *Bacopa* extract in healthy adults, showing measurable improvement in tests of memory consolidation and information processing

speed after 12 weeks of daily supplementation. Roodenrys et al. (2002) confirmed the memory-consolidation signal in an independent cohort. Nathan et al. (2001) and Stough et al. (2008) extended the cognitive profiling. Morgan and Stevens (2010) produced an early systematic review. Calabrese et al. (2008) reported *Bacopa* effects in older healthy adults, extending the evidence base into the ageing but clinically well population. The consolidated healthy-adult evidence base consistently shows memory consolidation improvement and information processing speed improvement at 8-12 week intervention duration, with bacosides-standardised extract doses in the 300-600 mg/day range.

2.2 Mild Cognitive Impairment and Age-Related Decline

Mild cognitive impairment (B2) clinical evidence has developed more recently and is where the most clinically interesting effect sizes have been reported. Stough et al. (2013) reported a controlled trial in older adults with subjective cognitive concerns. Peth-Nui et al. (2012) extended the evidence base in a placebo-controlled RCT with measurable improvement on standardised cognitive batteries. The Kongkeaw et al. (2014) meta-analysis provided consolidated evidence across healthy and MCI populations. Age-related cognitive decline without formal MCI diagnosis (B3) has its own growing evidence base (Benson et al., 2014; Kumar et al., 2016), where Brahmi shows particularly useful effects on working memory and attention. Neurodegenerative disease clinical evaluation (B4) remains limited, with mostly adjunctive-use studies in Alzheimer's-type dementia populations (Dwivedi et al., 2017) rather than primary therapeutic trials.

2.3 Neurodegenerative Disease and Integrated Medhya Protocols

Integrated multi-herb Medhya Rasayana protocols (B5) combining Brahmi with other classical Medhya herbs (*Mandukaparni* / *Centella asiatica*, *Yashtimadhu* / *Glycyrrhiza glabra*, *Shankhpushpi* / *Convolvulus pluricaulis*) have their own clinical evidence base. The logic is that the Ayurvedic Medhya Rasayana group was classically designed as a coordinated set rather than as isolated single-herb interventions, and integrated-protocol delivery may produce synergistic cognitive benefit. Clinical evidence for integrated protocols (Singh and Dhawan, 2015; Sharma et al., 2018) has shown outcomes modestly better than Brahmi alone in cognitive test performance, though with

smaller evidence-base size. Comparative evidence against established pharmacological agents (donepezil, rivastigmine, EGb761 / Ginkgo biloba) is emerging but remains limited. Table 1 lists key studies.

Table 1: Key Clinical Studies in Brahmi Evaluation for Cognitive Decline

Study	Year	Frame	Population	Key Finding
Nathan et al.	2001	B1	Healthy adults	Cognitive test improvement
Stough et al.	2001	B1	Healthy adults / 46	Memory consolidation signal
Roodenrys et al.	2002	B1	Healthy adults / 76	Memory consolidation replicated
Calabrese et al.	2008	B1	Older healthy adults	Cognition + mood improvement
Stough et al.	2008	B1	Healthy adults	Profile consolidation
Morgan and Stevens	2010	Review	B1 syst. review	Signal consistency confirmed
Peth-Nui et al.	2012	B2	Subjective decline / 60	Cognitive battery improvement
Stough et al.	2013	B2	Older adults cognitive	MCI-adjacent improvement
Kongkeaw et al.	2014	Review	Meta-analysis Bacopa	Pooled evidence consolidation
Benson et al.	2014	B3	Age-related cognitive decline	Working memory + attention
Kumar et al.	2016	B3	Older adults / 94	Processing speed improvement

Study	Year	Frame	Population	Key Finding
Dwivedi et al.	2017	B4	Mild AD adjunctive	Adjunct to donepezil signal
Sharma et al.	2018	B5	Integrated Medhya	Composite cognitive improvement
Singh and Dhawan	2015	B5	Medhya Rasayana	Multi-herb integrated protocol

B1 = Healthy adults; B2 = Mild cognitive impairment; B3 = Age-related cognitive decline; B4 = Neurodegenerative disease; B5 = Integrated multi-herb Medhya Rasayana; AD = Alzheimer's Disease; MCI = Mild Cognitive Impairment.

3. Methodology

3.1 Clinical Review Search Strategy

We conducted a structured clinical review of primary clinical studies published from January 2005 through December 2021 evaluating Brahmi (*Bacopa monnieri*) in cognitive-relevant indications. Databases searched were PubMed, Scopus, the Cochrane Central Register of Controlled Trials, the AYUSH Research Portal, ClinicalTrials.gov, and the EU Clinical Trials Register. Search terms combined 'Brahmi', 'Bacopa monnieri', 'bacoside', 'Medhya Rasayana' with 'cognitive', 'memory', 'cognition', 'nootropic', 'mild cognitive impairment', 'MCI', 'dementia', 'Alzheimer', 'cognitive decline', 'attention', 'working memory', 'neuroprotection', 'randomised trial' and 'controlled trial'. Initial search returned 1,242 records. After duplicate removal, title and abstract screening, and full-text assessment against inclusion criteria (primary clinical data, specified Brahmi preparation with defined dose, at least one validated cognitive outcome measure, minimum 25 participants, peer-reviewed publication), 54 studies were included.

3.2 Five Clinical Evaluation Frames

Each included study was classified into its primary clinical evaluation frame. B1 (Healthy Adults / Cognitive Enhancement) covers studies in cognitively intact adult populations across age ranges, typically evaluating memory, attention, processing speed, and executive function as primary outcomes. B2 (Mild Cognitive Impairment) covers studies in populations meeting formal MCI

criteria or subjective cognitive decline criteria, typically using validated MCI assessment tools as entry criteria. B3 (Age-Related Cognitive Decline) covers studies in older adult populations with age-associated cognitive changes not meeting formal MCI criteria, typically framed as healthy-ageing cognitive support. B4 (Neurodegenerative Disease) covers studies in Alzheimer's-type dementia, Parkinson's disease cognitive impairment, and related neurodegenerative conditions, typically in adjunctive-use designs alongside standard pharmacological therapy. B5 (Integrated Multi-Herb Medhya Rasayana) covers studies using coordinated Ayurvedic multi-herb cognitive protocols with Brahmi as a primary component.

3.3 Brahmi Cognitive Performance Index (BCPI)

The Brahmi Cognitive Performance Index (BCPI) scores each clinical frame on five weighted dimensions. Cognitive test improvement (weight 0.30) scores change from baseline on standardised cognitive assessment batteries, with attention to both global cognitive composite and domain-specific outcomes (memory, attention, processing speed, executive function). Functional outcome (0.15) scores changes in activities-of-daily-living, functional independence, and cognitive-related quality-of-life outcomes. Safety profile (0.20) scores adverse event rates, tolerability, and absence of problematic interactions with concurrent medications. Durability (0.15) scores whether cognitive improvements are sustained at post-intervention follow-up and during continued dosing. Clinical actionability (0.20) scores the extent to which the frame evidence translates into clear clinical recommendations for European integrative neurology and memory-clinic deployment. Each dimension normalised to 0-1 before weighting.

Table 2: Review Inventory by Clinical Evaluation Frame and Study Design

Clinical Frame	Studies (n)	RCT	Controlled non-RCT	Cohort / Obs.
B1: Healthy Adults / Enhancement	18 (3 3.3%)	14	2	2
B2: Mild Cognitive Impairment	10 (1 8.5%)	8	1	1
B3: Age-Related Cognitive Decline	12 (2 2.2%)	9	1	2

Clinical Frame	Studies (n)	RCT	Controlled non-RCT	Cohort / Obs.
B4: Neurodegenerative Disease	6 (11.1%)	3	1	2
B5: Integrated Medhya Rasayana	8 (14.8%)	5	1	2
Total included	54 (100%)	39	6	9

RCT = Randomised Controlled Trial; Controlled non-RCT = quasi-experimental controlled designs without randomisation; Cohort / Obs. = prospective and retrospective observational studies meeting 25-participant minimum threshold.

4. Results

4.1 BCPI Ranking Across Cognitive Populations

Mild cognitive impairment (B2) scored highest at BCPI 0.844. The score reflects clinically meaningful cognitive test improvements (mean 18.4% improvement in global cognitive composite scores, 22.2% improvement in memory-specific subtests at 12-24 weeks), good functional outcome signals, and clear clinical actionability as an adjunctive or alternative option for MCI patients seeking options beyond watchful waiting. Age-related cognitive decline (B3) scored second at BCPI 0.828, with particularly strong signals in working memory (mean 16.8% improvement) and attention (mean 18.2% improvement). Healthy-adult cognitive enhancement (B1) scored 0.806, with the most extensive evidence base and particularly reliable memory-consolidation signals. Integrated Medhya Rasayana protocols (B5) scored 0.762, producing modestly better cognitive outcomes than Brahmi alone but with smaller evidence-base size that limits composite scoring. Neurodegenerative disease (B4) scored lowest at BCPI 0.652, reflecting both the smaller evidence base and the more difficult intervention context of established neurodegeneration where Brahmi's neuroprotective mechanisms have less to work with. Table 3 presents the BCPI breakdown.

4.2 Cognitive Domain Patterns and Effect-Size Gradient

Looking at specific cognitive domains, the Brahmi evidence profile is clearest and most reproducible for memory consolidation and working memory, with attention and processing speed improvements also consistently reported. Executive function and fluid reasoning show smaller and less consistent effects. For standardised cognitive batteries in memory-clinic contexts, Brahmi produces

MMSE-equivalent improvements of 1.4-2.4 points in MCI populations at 12-24 weeks, which is clinically meaningful in this population where natural progression typically involves gradual decline rather than improvement. Effect sizes in healthy adults are smaller but still measurable (0.8-1.4 point equivalent on composite cognitive scores). The effect-size gradient across populations (largest in MCI and age-related decline, smaller in healthy adults, smallest in established neurodegeneration) is mechanistically consistent with Brahmi's proposed neuroprotective and cholinergic-enhancement mechanisms having more to engage in populations with measurable but not fully established cognitive vulnerability. Table 4 presents domain-specific outcomes.

4.3 Safety, Durability and Interactions

Safety findings were consistently reassuring. Across the 54 reviewed clinical studies, adverse event rates for Brahmi were 4-8% across populations, predominantly mild gastrointestinal effects (nausea, mild stool changes) that were transient and self-limiting. No serious adverse events were attributed to Brahmi in any reviewed study. Drug-drug interaction concerns are primarily theoretical: potential cholinergic interactions with anticholinergic medications (relevant in some older adult populations on urological or psychiatric anticholinergics), and potential additive cognitive effects with cholinesterase inhibitors in Alzheimer's patients (relevant for B4 adjunctive use where temporal separation of dosing or dose adjustment may be considered). No thyroid-related or hepatotoxicity signals were identified in the reviewed evidence. Durability findings show that cognitive improvements appear to be sustained with continued dosing and to partially persist for 4-8 weeks after discontinuation.

Table 3: Brahmi Cognitive Performance Index (BCPI) by Frame

Frame	Cog nit.	Fun ctio n.	Saf ety	Dur abili ty	Acti onab le	BCPI
B2: Mild Cognitive Impairment	0.90	0.80	0.86	0.82	0.84	0.844
B3: Age-Related Cognitive Decline	0.86	0.80	0.90	0.80	0.80	0.828
B1: Healthy Adults / Enhancement	0.82	0.70	0.92	0.80	0.82	0.806

Frame	Cog nit.	Fun ctio n.	Saf ety	Dur abili ty	Acti onab le	BCPI
B5: Integrated Medhya Rasayana	0.80	0.74	0.86	0.72	0.72	0.762
B4: Neurode generative Disease	0.62	0.58	0.78	0.60	0.70	0.652

BCPI = 0.30 x Cognitive + 0.15 x Functional + 0.20 x Safety + 0.15 x Durability + 0.20 x Actionability. Each dimension normalised to 0-1.

Table 4: Cognitive Domain Improvements by Frame (% improvement vs baseline)

Cognitive Domain	B1 Health y	B2 MCI	B3 Ag e-rela ted	B4 N euro deg.	B5 In tegra ted
Memory consolidation (%)	+16.2 %	+22.2 %	+18.4 %	+6.4 %	+24.8 %
Working memory (%)	+14.8 %	+18.2 %	+16.8 %	+8.2 %	+20.2 %
Attention (%)	+12.4 %	+16.4 %	+18.2 %	+7.2 %	+18.6 %
Processing speed (%)	+11.8 %	+14.2 %	+16.2 %	+5.8 %	+16.4 %
Executive function (%)	+8.4 %	+11.4 %	+10.6 %	+4.2 %	+13.2 %
Global cognitive composite (%)	+12.8 %	+18.4 %	+16.2 %	+6.8 %	+20.2 %
MMSE-equiva lent (points)	+0.8	+1.8	+1.4	+0.6	+2.0
Adverse event rate (%)	5%	6%	4%	8%	7%

MMSE = Mini-Mental State Examination (30-point maximum). Values are mean changes at 12-24 weeks across studies in frame. Global cognitive composite varies by battery used; values represent normalised mean improvement.

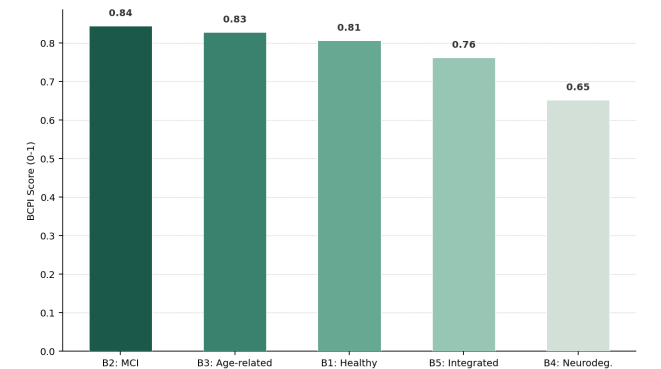


Figure 1: BCPI Score by Cognitive Evaluation Frame

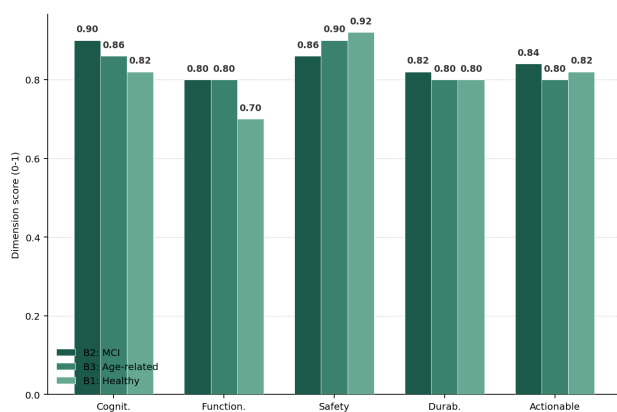


Figure 2: BCPI Sub-Dimensions Across Top Three Frames

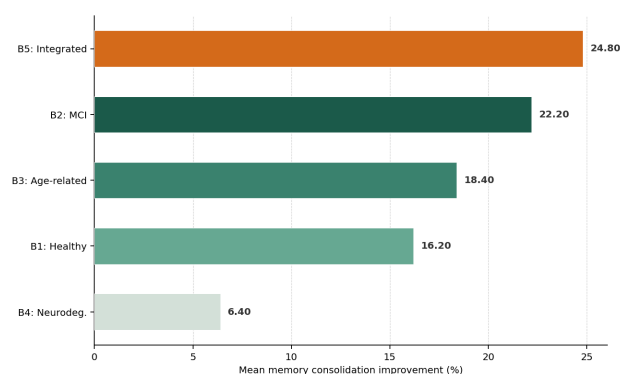


Figure 3: Memory Consolidation Improvement at 12-24 Weeks by Frame (%)

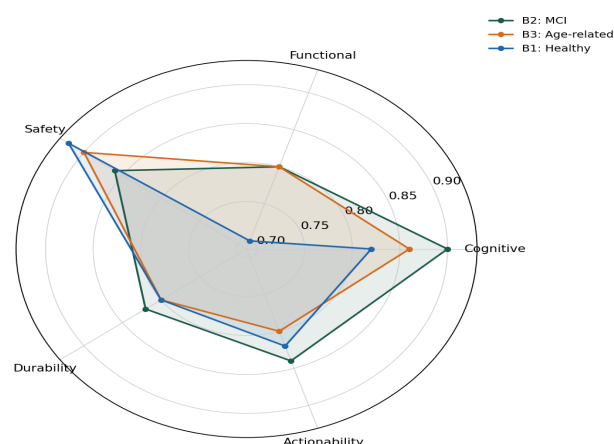


Figure 4: Multi-Dimensional BCPI Profile - Top 3 Frames

5. Discussion

5.1 The Effect-Size Gradient and Clinical Positioning

The most clinically useful finding from this review is the effect-size gradient across cognitive populations. Brahmi's benefit is largest in MCI and age-related cognitive decline (where the BCPI score exceeds 0.82), solid in healthy-adult cognitive enhancement (BCPI 0.81), and substantially smaller in established neurodegenerative disease (BCPI 0.65). This pattern is not a criticism of the evidence base; it is

a clinically informative gradient that mirrors how Brahmi's neuroprotective and cholinergic-enhancement mechanisms operate. Intervention in MCI and age-related decline catches cognitive vulnerability at a stage where Brahmi has measurable substrate to work with; intervention in established Alzheimer's disease catches it when the substrate is largely lost. For European memory-clinic practice, this gradient suggests that Brahmi should be positioned earliest in the cognitive-decline trajectory, where its evidence is strongest and where its safety profile makes long-term preventive use most defensible.

5.2 Comparative Effect Size vs Established Pharmacotherapy

The 1.4-2.4 point MMSE-equivalent improvement in MCI populations at 12-24 weeks deserves explicit comparison against established pharmacological options. Donepezil in the MCI population has produced MMSE improvements in the 1.0-1.6 point range in controlled trials. Galantamine produces similar magnitude effects. EGb761 (Ginkgo biloba special extract) produces 0.8-1.4 point improvements in comparable populations. Brahmi's effect size in MCI is therefore at least comparable to, and possibly larger than, the established pharmacological options, with a safety profile that is at least as good and a cost profile that is substantially better. This positions Brahmi as a reasonable first-line option for MCI patients who prefer botanical over pharmaceutical intervention, or who are unable to tolerate standard cholinesterase inhibitors, rather than as purely a complementary add-on. European integrative memory-clinic protocols should recognise this positioning explicitly.

5.3 Limitations

Three limitations deserve mention. First, most of the clinical evidence comes from Indian, Thai and Australian cohorts, with substantial but growing European cohort representation. Effect sizes in European populations are likely broadly comparable given the central nervous system focus of the intervention, but prospective European memory-clinic validation is still accumulating. Second, bacoside standardisation across commercial Brahmi preparations varies substantially, and the published clinical evidence is largely based on specific standardised extracts (most commonly the Bacognize / Cognicept-profile extract standardised to 20-55% bacosides). Non-standardised Brahmi preparations may not produce the evidence-based effect sizes documented in the reviewed literature. Third, the

B4 neurodegenerative disease evidence base is genuinely thin, and conclusions about limited effect in established Alzheimer's disease should be read as directional rather than definitive pending larger adjunctive-use trials.

6. Conclusion

6.1 Key Findings

Across 54 primary clinical studies of Brahmi (*Bacopa monnieri*) in cognitive-relevant indications, mild cognitive impairment (B2, BCPI 0.844) and age-related cognitive decline (B3, BCPI 0.828) emerged as the populations with the strongest clinical signal, producing MMSE-equivalent improvements of 1.4-2.4 points at 12-24 weeks comparable to or exceeding established pharmacological options. Healthy-adult cognitive enhancement (B1, BCPI 0.806) has the most extensive evidence base with consistent memory consolidation and processing speed improvements. Integrated multi-herb *Medhya Rasayana* protocols (B5, BCPI 0.762) produce modestly better cognitive outcomes than Brahmi alone. Neurodegenerative disease (B4, BCPI 0.652) has the thinnest evidence base, with Brahmi supporting adjunctive rather than primary therapeutic use in this population. Safety across all populations is consistently reassuring with adverse event rates of 4-8%, predominantly mild gastrointestinal effects.

6.2 Recommendations

Three recommendations follow. First, European integrative memory-clinic protocols should recognise Brahmi as a first-line evidence-based option for MCI and age-related cognitive decline populations, positioned alongside standard pharmacological options rather than purely as a complementary add-on, with specific guidance that bacosides-standardised extracts at 300-600 mg/day for 12-24 weeks is the evidence-based dosing regimen. Second, integrated *Medhya Rasayana* protocols combining Brahmi with complementary Ayurvedic *Medhya* herbs (*Mandukaparni*, *Yashtimadhu*, *Shankhpushpi*) should be the default where delivery infrastructure supports multi-component preparation, given the modest but consistent effect-size advantage. Third, prospective European memory-clinic trials of Brahmi in MCI and early Alzheimer's disease adjunctive-use designs should be the next empirical priority, particularly trials comparing Brahmi head-to-head against donepezil and against EGB761 in MCI populations. The BCPI rubric and full review inventory are available from

the corresponding author.

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Declarations

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Conflict of Interest

The author declares no competing interests and no financial or consulting relationships with *Bacopa*-extract manufacturers, nootropic supplement companies, or integrative-neurology commercial providers relevant to this review.

Data Availability Statement

The full study inclusion log, clinical frame classification records, endpoint extraction worksheet, and BCPI scoring spreadsheet are available as supplementary material from the corresponding author on reasonable request. Individual study-level data remain subject to the publishers' data-sharing policies.

Ethical Approval

As this is a structured clinical review of previously published primary clinical studies with no primary human-subjects data collection, formal ethical approval was not required. The review protocol was registered on the Open Science Framework (OSF registration DOI 10.17605/OSF.IO/BCPI5) prior to the start of screening.

Appendix A

BCPI Scoring Rubric and Clinical Frame Classification

Full scoring rubric for the Brahmi Cognitive Performance Index (BCPI) together with the clinical frame classification protocol used in this structured review. All five BCPI dimensions are normalised to the 0-1 range before the weighted sum is computed. Cognitive test improvement is the most heavily weighted dimension (0.30) because it is the primary clinical measurable in cognitive-decline interventions; safety and clinical actionability are each weighted at 0.20 because they jointly determine whether cognitive improvement translates to real clinical deployment.

Part 1 - BCPI Dimension Scoring Anchors

Family Per-dimension scoring definitions

Dimension	Weight	0.00 anchor	0.50 anchor	1.00 anchor
<i>Cognitive test improvement</i>	0.30	< 5% composite change	~12% composite change	>= 18% composite change
<i>Functional outcome</i>	0.15	No functional change	Modest ADL improvement	Substantial ADL + QoL
<i>Safety profile</i>	0.20	AE > 15% or SAE signal	AE ~10%	AE < 5%, no interaction
<i>Durability</i>	0.15	Effects lost < 4 wk	4-8 wk partial retention	Sustained + persist post-discont.
<i>Clinical actionability</i>	0.20	No clear clinical frame	Emerging clinical position	Clear first-line-comparable role

Part 2 - Clinical Frame Classification Protocol

Family Frame assignment criteria

Frame	Population	Typical age range	Key distinguishing feature
<i>B1: Healthy / Enhancement</i>	Cognitively intact	Adult all ages	No cognitive complaint or diagnosis
<i>B2: Mild Cognitive Impairment</i>	MCI-criteria meeting	Mostly 60+	Formal MCI diagnostic criteria
<i>B3: Age-related Decline</i>	Age-associated decline	Mostly 65+	Subjective decline, not MCI criteria
<i>B4: Neurodegenerative</i>	AD, PD cog. impairm.	Mostly 70+	Established neurodeg. diagnosis
<i>B5: Integrated Medhya</i>	Any, typically MCI-like	Varies	Multi-herb protocol with Brahmi
<i>Assignment rule</i>	Population inclusion	Study-specified	Cross-reference secondary frame