



Bacopa

Bacopa monnieri

PRACTICE POINTS

- Bacopa is a cognitive enhancer (nootropic) that improves learning, memory and attention, with calming and anxiety reducing effects.¹⁻³
- Standardisation of the main active constituents, bacosides, to 40-55% is important for favourable clinical outcomes.²
- Its wide range of pharmacological actions focuses on cognition and brain health.^{3,4} Secondary clinical considerations include anhedonia/depression and neurodegenerative diseases.⁵⁻⁷
- Supplemental bacopa is generally well tolerated with a good safety profile. Mild gastrointestinal complaints have been reported if taken on an empty stomach; therefore, it is recommended with food.^{2,3}

PLANT OVERVIEW

Bacopa (or water hyssop) is a creeping perennial herb native to many countries, including India where for over 3000 years it has been known as Brahmi. The whole plant is used therapeutically as a calming nootropic.^{3,8}

In traditional Ayurvedic medicine, bacopa is described as "medhya rasayana", which means it is used for improving mental health, memory, intellect and for promoting longevity and rejuvenation. It is also traditionally used to reduce anxiety (anxiolytic).³

THE CALMING NOOTROPIC

Scientific research and traditional medicine both support bacopa as a calming nootropic due its clinical benefits in:³

- cognition
- memory
- learning
- information processing
- anxiety/stress reduction.



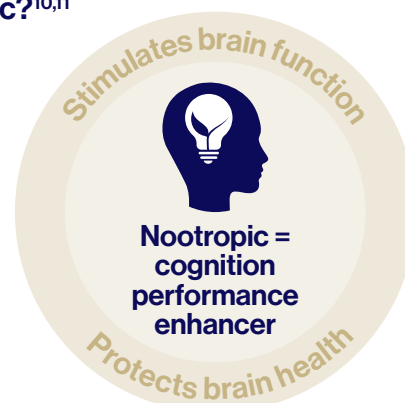
Bacopa's active constituents, **bacosides, cross the blood brain barrier** through a lipid (fat) diffusion process.⁹

This is important for nootropic effects.¹⁰

What is a nootropic?^{10,11}

Nootropics improve cognitive functions such as:^{10,11}

- ✓ Thinking
- ✓ Memory
- ✓ Attention
- ✓ Motivation
- ✓ Creativity
- ✓ Learning

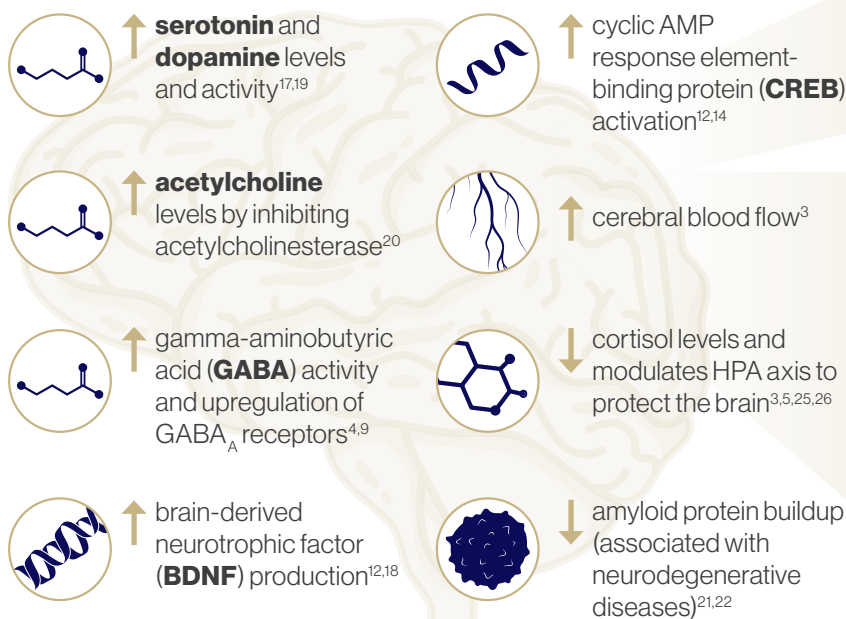


Natural nootropics protect the brain, boost brain function and make the brain healthier.¹⁰

ACTIONS & BENEFITS

How bacopa influences major neurological pathways involved in cognition¹⁷

Mechanisms



Actions

- Nootropic
- Neuroprotection
- Neurotransmitter modulation

Benefits

Enhances:

- Cognition
- Memory and recall
- Attention and concentration
- Learning and information processing

Supports:

- Brain protection

Reduces:

- Anxiety
- Stress

Roles of the key neurochemicals for cognition and brain health

Neurotransmitters

- Serotonin and dopamine are key neurotransmitters involved in **learning, memory** and **mood**^{17,19}
- Acetylcholine is a cholinergic neurotransmitter that plays key roles in **attention, recall** and **memory formation**²⁰
- GABA is the brain's major inhibitory neurotransmitter to calm nerve excitability.²¹ It is needed for improving **rapid decision-making** and plays a central role in **cognition, learning** and **memory** and has **anxiety** and **stress-reducing** effects^{3,23,24}

BDNF

- Supports nerve cell growth and survival, and neuroplasticity^{12,18}
- Is essential for **cognition, learning** and **memory**^{12,18}
- Low BDNF levels are associated with stress, depression and neurodegenerative diseases^{12,18}

CREB

- Improves nerve communications for **cognition** and **memory**^{12,14}
- May increase **cognitive reserves** by supporting BDNF production¹²

Bacopa's role as a nootropic is enhanced by its neuroprotective effects, which support brain health by alleviating neuroinflammation and reducing oxidative damage to neurons.



Anti-inflammatory

- Inhibits key proinflammatory molecules that if left active for prolonged periods can lead to nerve cell damage and affect cognitive processes. These include:¹²⁻¹⁴
 - nuclear factor kappa B (NF-κB)
 - tumour necrosis factor alpha (TNF-α)
 - interleukin-6 (IL-6).
- Reduces neuroinflammation to improve learning and memory and support brain health¹²⁻¹⁴



Antioxidant

- Reduces reactive oxygen species (ROS)¹⁴
- Protects against oxidative damage to neurons causing degeneration and brain cell death¹⁴⁻¹⁶
- Increases antioxidant enzymes, which can restore the oxidative/antioxidant balance¹⁴⁻¹⁶
- Oxidative stress plays a key role in:¹⁵
 - memory impairment
 - anxiety
 - mood changes
 - neurodegenerative diseases.

MAIN BIOACTIVE COMPOUNDS

- Bacopa contains many complex active constituents including saponins, alkaloids, flavonoids, glycosides and other phytochemicals^{3,4}
- The collective group of saponins in bacopa called bacosides are thought to be the main actives responsible for enhancing cognitive performance**^{3,4}
- Bacoside A and B have been isolated and tested, with bacoside A showing the greatest pharmacological activity as a potent brain antioxidant, anti-inflammatory and neuroprotector^{3,4,14}
- Bacoside A and another major saponin with neuroprotective properties, bacopaside I, make up 96% of the total saponins in bacopa^{27,28}

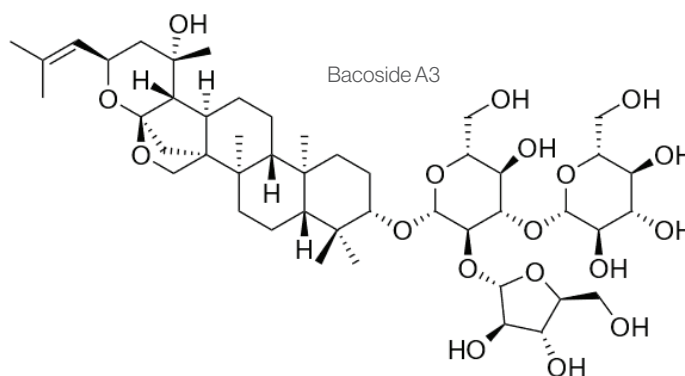


Figure 1: Chemical structure of bacoside A3- one of the constituents of bacoside A⁸

Are more bacosides better?

The optimal percentage of bacosides in bacopa extracts may depend on its intended use. Research has used levels of 12%; however, most clinical studies use the higher 40-55% bacoside standardisation for cognitive enhancement.²



Standardised to:

**40-55%
bacosides**

- ✓ **Nootropic**
- ✓ **Neuroprotector**

The importance of whole plant and standardised extracts

Although bacosides are thought to be the main bioactive constituents, the entirety of compounds act synergistically to provide beneficial effects.^{3,9} Therefore, there is a therapeutic advantage to using whole bacopa preparations that are standardised to a certain level of bacosides.

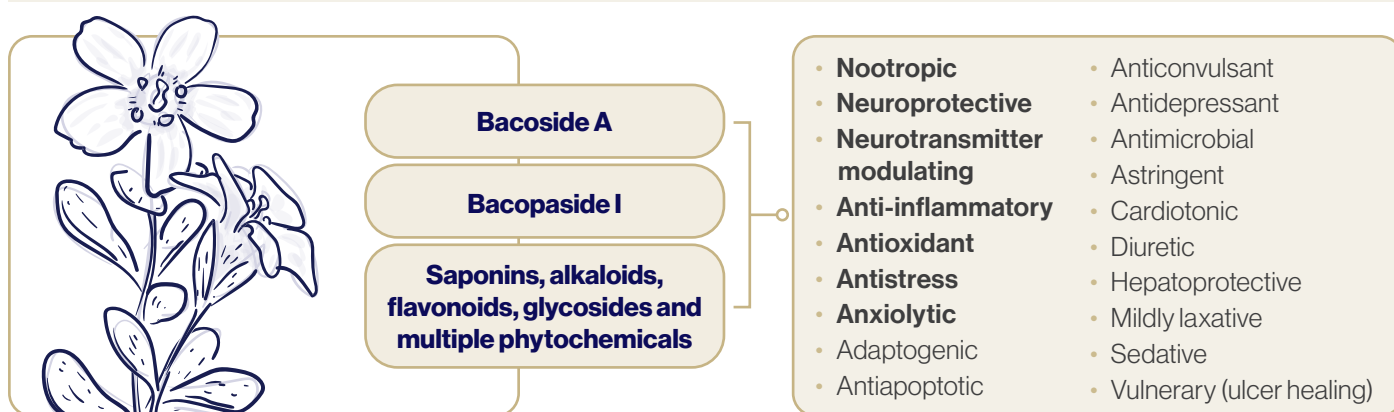


Figure 2. The constituents of bacopa and their main pharmacological actions^{1,21,29}

Summary of actions and benefits



Nootropic

Enhances cognition, learning and memory



Neuroprotection

Reduces neuroinflammation, neurodegeneration and oxidative stress



Mood regulation

May reduce stress and anxiety and promote calmness

BACOPA FOR ADULTS 18-60 YEARS: CLINICAL EVIDENCE

As cognitive impairment increases exponentially every five years after the age of 65,¹⁴ many bacopa studies have focused on older adults, with beneficial cognitive outcomes.^{12,30,31} However, factors other than age can also affect brain health and cognition across adulthood. These factors include:^{14,32,33}

- genetics
- lifestyle
- sleep
- work
- education level
- health and illness
- financial status
- social connectedness
- environment.



Table 1: Bacopa studies for cognition, memory and learning in adults aged 18 to 60 years.

RANDOMISED CONTROLLED TRIAL	DOSE AND DURATION	OUTCOMES (COMPARED TO PLACEBO)
Healthy adults (n=46) 18-60 yrs (mean age 28-50)	320 mg (55% bacosides) daily for 12 weeks ³⁴	Improved memory consolidation, learning rate and speed of visual information processing. Reduced state anxiety levels. Maximum effects were seen at 12 weeks.
Healthy adults (n=62) 18-60 yrs (mean age 28-55)	320 mg (55% bacosides) daily for 90 days ³⁵	Spatial working memory accuracy and rapid visual information processing were improved. Potential benefits in attention and psychomotor task performance.
Healthy adults (n=24) 18-56 yrs	320 mg or 640 mg (55% bacosides) for 3 days, with each dose separated by a week ³⁶	320 mg dose improved cognitively demanding test scores, with acute nootropic effects in cognitive speed, reasoning and attention.
Healthy adults (n=17) 18-44 yrs (mean age 19-31)	320 mg or 640 mg (55% bacosides) for 3 days, with each dose separated by a week ³⁷	320 mg dose demonstrated the potential to acutely enhance specific aspects of cognitive function related to information processing, attention and memory 1 and 2 hours after consumption, with an accompanying increase in alertness at 2 hours. Cortisol levels were reduced in the study, with the authors noting bacopa has potential adaptogenic effects.
Medical students (n=58) 19-22 yrs	150 mg (45% bacosides) twice daily for 6 weeks ²⁹	Improved working memory and immediate recall of logical material in students with high cognitive ability, with possible effects on attention and reductions in distractibility.
Healthy adults (n=20) 20-40 yrs	300 mg (percentage of bacosides not stated) daily for 8 weeks ³⁸	Improved spatial ability (important for cognitive function) and lowered beta brain waves during the spatial ability test. As beta brain waves can be associated with stressful conditions and difficulty concentrating, the researchers suggest the lowering effects may be due to bacopa's calming properties.



Research shows standardised bacopa extracts can **rapidly improve cognition**, especially when engaged in cognitively challenging or stressful situations.^{36,37}

INTERACTIONS & SAFETY

Medication-bacopa interactions

MEDICATION	NATURE AND MECHANISM OF INTERACTION	EVIDENCE	LIKELIHOOD OF INTERACTION	SEVERITY OF OUTCOME	RECOMMENDATION
Acetylcholinesterase (AChE) inhibitors, anticholinergic drug, cholinergic drug	Bacopa may increase acetylcholine levels due to inhibition of acetylcholinesterase. Therefore, may increase effect of AChE inhibitors and cholinergic drug and decrease effectiveness of anticholinergic drug. ^{3,20,39}	Animal studies Randomised controlled trials	Likely	Moderate	Use with caution and monitor the patient.
CYP450 enzyme substrates (CYP1A2, CYP2C19, CYP2C9, CYP3A4)	Bacopa may increase or decrease blood levels of drug, and therefore drug effect, via inhibition of these enzyme activities. ^{3,39}	In vitro studies	Theoretical	Variable – dependant on drug and disease state	Use with caution and monitor the patient.
Thyroid hormone	Bacopa may increase T4 levels, and therefore may have an additive effect to the drug. ^{3,22,39}	Animal studies	Theoretical	Moderate	Use with caution and monitor the patient for signs of hyperthyroidism.



Safety

Clinical studies state that bacopa is safe to use at the doses and duration reported. Preclinical and toxicology studies support its general safety.^{9,22,29}



Side effects

Bacopa is generally well tolerated. The most common side effects are mild gastrointestinal problems including increased stool frequency, nausea, abdominal cramps and diarrhoea.^{2,3} This may be due to its saponin content or the upregulation of acetylcholine activity.³



Pregnancy and breastfeeding

There is insufficient research to establish safety in pregnancy or lactation for bacopa or nootropics generally.^{1,11}



Key prescribing notes

Take bacopa preparations:

- With food, to reduce the potential of gastrointestinal side effects¹
- With a meal containing fat, to increase the absorption of the fat-soluble bacosides¹

Duration of action for benefits:

- Clinical trials show bacopa may take 6-12 weeks for the full benefits. However, acute studies show some effects may be rapid.^{1,36,37}



Clinical evidence-based dosage guide for the prescribing of bacopa supplements

RESEARCH OUTCOME/CONDITION	LEVEL OF EVIDENCE	BACOSIDE %	DOSAGE AND DURATION
Acute nootropic effects	C	55%	320 mg acute dose/day ^{36,37}
Alzheimer's disease (AD), mild cognitive impairment (MCI) and dementia	C	Not stated	300 mg/day for 12 months ⁶ 250 mg twice daily for 3 months ⁴⁰
Anhedonia/Depression	C	20%	300 mg twice daily alongside conventional antidepressant (citalopram 40 mg/day) for 4 weeks ⁵
Anxiety/Stress	B/C	55%	320 mg/day for 12 weeks ³⁴ 320 mg acute dose/day ³⁷
Cognitive attention	A/B	Most 50-55%	300-320 mg/day for 12 weeks ²
	C	55%	320 mg acute dose/day ³⁶
Cognitive attention and verbal fluency in mild cognitive impairment (MCI)	C	Not stated	160 mg twice daily for 2 months ⁴¹
Cognitive flexibility and executive function	A/B	55%	320 mg/day for 12 weeks ^{2,34}
Cognition in older adults: memory, attention and learning	C	40-50%	300 or 450 mg/day for 12 weeks ^{30,31}
	C	55%	320 mg/day for 3 months ¹²
Emotional wellbeing, general health and pain-related symptoms	B	12%	150 mg twice daily for 28 days ¹⁹
Energy and alertness	B/C	55%	320 mg/day for 90 days ³⁵ 320 mg acute dose/day ³⁷
Information processing and learning rates	B	55%	320 mg/day for 12 weeks/90 days ^{34,35}
Memory (consolidation/retention/recall/working)	B/C	55%	320 mg/day for 12 weeks/90 days ^{34,35} 320 mg acute dose/day ³⁷
	B	45%	150 mg twice daily for 6 weeks ²⁹
Parkinson's disease (emotional function)	C	Not stated	225 or 450mg/day for 90 days ^{14,42}
Spatial ability	C	Not stated	300 mg/day for 8 weeks ³⁸

Evidence levels:

A: Meta-analysis and/or systematic review B: High quality clinical trial C: Good quality clinical trial

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