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FILE: ■Bacopa (*Bacopa monniera*)
■Nootropic Herbs
■Memory

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RE: *Bacopa monniera* and its Potential to Enhance Brain Function: An Overview

Russo A, Borrelli F. *Bacopa monniera*, a reputed nootropic plant: an overview. *Phytomed*. 2005;12:305-317.

Nootropic herbs and drugs are used to enhance memory, cognition, mood, and other factors associated with mental functioning. Examples of herbs with nootropic activity include ginkgo (*Ginkgo biloba*) and gotu kola (*Centella asiatica*). Bacopa (*Bacopa monniera*) is an herb used in Ayurvedic medicine to treat anxiety, mental illness, memory disorders, and epilepsy and has demonstrated nootropic activity in preliminary studies.

Bacopa is found in wetlands throughout the Indian subcontinent and is a commonly naturalized in other parts of the world including the United States. It is known locally in India as Brahmi, due to the plant's association with the Hindu god Brahma. Bacopa has been used for almost 3,000 years in Ayurvedic medicine. The plant is mentioned in several Ayurvedic texts including the *Caraka Samhita* and the *Bravpra-kash Var-Prakarana* as a treatment for a range of mental conditions. Bacopa is a member of the Scrophulariaceae family and is characterized by purple flowers that appear in summer and fleshy oblong leaves. The plant is a creeping herb that grows in wet and sandy areas near streams.

Alkaloids isolated from Bacopa include brahmine, nicotine, and herpestine. Bacoside A, which co-occurs with Bacoside B, has been suggested to be the main constituent responsible for Bacopa's cognitive effects. Other constituents isolated from Bacopa include dammarane-type triterpenoid saponins, a dammarane-type pseudojujubogenin glycoside, pseudojujubogenin glycosides, and phenylethnoid glycosides.

Bacopa demonstrates antidementic, antioxidant, and cognitive-enhancing effects in several in vivo and in vitro studies. One in vivo study demonstrates that Bacopa enhances learning ability in rats, this activity was attributed to the Bacopa saponins bacosides A and B. Bacopa extracts administered to mice demonstrate antidementic activity when tested against scopolamine. In addition, bacopa demonstrates anxiolytic activity in rats, antidepressant activity comparable to imipramine in rodent models of depression, and anticonvulsive activity in mice and rats.

In vivo and in vitro studies demonstrate that Bacopa has antioxidant activity that has been attributed to the bacoside fraction. In addition, Bacopa demonstrates hepatoprotective antioxidant activity when tested against morphine, "...establishing its protective role in morphine toxicity in rat liver."

In other in vitro and in vivo studies, Bacopa has shown anti-inflammatory activity, antiulcer activity, anti-*Helicobacter pylori* activity, adaptogenic activity, anticancer activity, relaxant properties on blood vessels, bronchodilatory properties, and spasmolytic activity.

Initial clinical trials demonstrate that Bacopa has positive effects on learning and memory. Two separate single-blind open clinical trials demonstrate that long-term administration of Bacopa may enhance memory and learning in patients with anxiety neurosis and in children. In a double-blind, placebo controlled study, long-term administration of Bacopa extracts (300 mg) improved "early information processing, verbal learning, and memory consolidation in humans." A larger clinical trial of 65 adults demonstrates that Bacopa has a positive effect on "retention of new information" but that "...rate of learning was unaffected." These studies demonstrate that Bacopa may have a positive effect on learning and cognition, especially when administered chronically. However, a study on acute administration of Bacopa (300 mg) did not show an effect on cognitive function, even when combined with ginkgo.

In vivo studies and clinical trials showed no obvious toxicity at doses commonly administered. An in vivo study in rats reported no toxicity of Bacopa extracts. A phase 1 double-blind placebo-controlled single-dose tolerance study with 31 healthy subjects showed no apparent toxicity when bacosides A and B were administered in doses ranging from 20 to 300 mg. Bacopa was well-tolerated in two other studies involving human subjects, including a multi-dose study.

Bacopa exhibits "neuroprotective and cognitive enhancing effects" in both in vitro and in vivo studies and in clinical trials. Clinical trials indicate that Bacopa's positive effects on early information processing and verbal learning are evident when Bacopa is administered chronically; no acute effects have been demonstrated. Bacopa's 3,000 year history of use, as well as in vivo studies and clinical studies, demonstrate that the herb is well-tolerated.

Larger clinical trials are needed to confirm Bacopa's nootropic activity. In addition, herb-drug and herb-herb interactions of Bacopa need to be studied. Bacopa's potential as an anti-epileptic treatment and as a treatment to correct side effects of anti-epileptic drugs is another area to be studied in the future.

—*Marissa Oppel, MS*

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