



A Critical Review on Phytopharmacological Activity of Different Herbs Used In Immunity Boosting and Brain Health Maintenance

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Abstract

This article offers a critical analysis of one such nootropic medicine, Medhya Rasayana, which is made with Bacopa monnieri extract. The Indian medical systems have used Brahmi (Bacopa monniera), a common herbal medication, for a long time to cure a variety of ailments. It is now appropriate to begin several clinical trials because the effectiveness of Brahmi in treating a variety of illnesses has been the subject of considerable research in recent years. As a Rasayana (tonic), With an iasomnifera (Ashwagandha) is a highly respected herb in the Indian Ayurvedic medical system. It is specifically utilized as a nervine tonic and is used for a variety of illness processes. Additionally, it was discovered to be helpful in treating neurological illnesses like Parkinson's, Huntington's, and Alzheimer's disease. The leaves and Immature seed pods of Moringa oleifera are utilized as food products in human nutrition, and the seeds, bark, roots, sap, and flowers are widely employed in traditional medicine. The highest antioxidant activity is found in leaf extracts, and several animal safety studies using aqueous leaf extracts show that they are generally harmless. Human studies were not associated with any negative effects that were documented.

Key Words: Brahmi, Nootropic, Indian Ginseng, Miracle Tree, pharmacological activity.

Introduction

Brahmi the term "Brahmi" refers to substances that promote brain health. The word "Brahma" refers to the Hindu pantheon's mythological creator, and as the brain serves as the body's focus of creative activity, it is named after him. In Charak Samhita, Brahmi makes his first explicit mention of memory enhancement¹. The well-known Ayurvedic herb brahmi is making a comeback as a therapy option for memory-related illnesses. Both Indian and Chinese traditional literature report on its therapeutic

potential. Although several chemical components have been identified from brahmi, bacoside-A and bacoside-B are found in the active parts of this medicinal plant. Brahmi contains a variety of other phytochemicals, including alkaloids, glycosides, flavonoids, saponins, and others.²⁻⁴

Ashwagandha is also referred to as "Indian Ginseng" or "Indian Winter cherry" (*Withania somnifera*, family Solanaceae). It has been used for millennia as a Rasayana for its extensive range of health effects,

making it one of the most significant herbs in Ayurveda (India's traditional medical system). Rasayana is defined as an herbal or metallic concoction that enhances happiness and fosters a young state of physical and mental health. The most important place belongs to Ashwagandha among the Ayurvedic Rasayana herbs. It is called as "Sattvic Kapha Rasayana" Herb.⁵ It is also known as a "royal herb," and it has a variety of medicinal benefits for the immune system, nervous system, endocrine system, aerobic energy-production system, and reproductive system.⁶⁻⁷

Moringa oleifera a member of the Moringaceae family, *Moringa oleifera* is a potent treatment for malnutrition. Because it contains a wide range of vital phytochemicals in its leaves, pods, and seeds, the moringa plant is extremely nutritious. In fact, moringa is claimed to have 25 times more iron than spinach and 7 times more vitamin C than oranges. It also has 10 times more vitamin A than carrots, 17 times more calcium than milk, and 9 times more protein than yoghurt.⁸ Certain ailments, including asthma, epilepsy, eye and skin conditions, fever, and haemorrhoids, are said to be treated by it.⁹⁻¹¹

Botanical Description

Botanical Description of Brahmi Plant

Bacopamonnieriis a non-aromatic perennial herb and it grows up to a height of 60-90 cm, with branches that are between 5 cm and 35 cm long.

Roots: The roots are tiny, wiry, and creamish-yellow in colour.

Stem: The stem is thin, green or purple-green, 1mm thick, made up of internodes and nodes, and has a mildly bitter flavour.

Seeds: There are many, erratic, or oblong seeds.

Leaves: The leaves are elongated, green, and sessile, bent, straight, inverse, crisscross, and have small dots and specks on the underside.

Flowers: They are 8 to 15 mm long and 4 mm wide small, axillary, five-petaled flowers that are white, purple, pink, or pale violet are also available.

Fruits: Fruits are ovoid, glabrous, pointy at the apex and purple when they are new. They can be up to 5mm long.¹²⁻¹⁶

Botanical Description of Ashwagandha Plant

The major therapeutic ingredient is roots. The fruit is a vivid red colour; the seeds are dried and grown as a medicinal plant. All plant components, including the roots, leaves, stem, green berries, fruits, seeds, and bark are utilized in medicine; each part has a unique function. Ashwagandha has branching branches with seeded yellow bottoms and green leaves.¹⁷

Botanical description of moringa oleifera plant: A tiny, quickly-growing evergreen or deciduous tree, *Moringa oleifera* can reach heights of 10 to 12 metres.

Leaves: The leaves are bipinnate or frequently tripinnate and can be up to 45 cm long.

Seeds: The seeds have a rounded shape and a diameter of 1 cm.

Flowers: The axillary panicles, which are 10 to 25 cm long and spread or droop, are covered with fragrant, bisexual, yellowish-white flowers on hairy stalks.

Pedicels: The pedicels are 6 to 30 mm long, and any bracteoles that are present are smaller than the pedicels.

Fruits: Fruits are tri-lobed capsules, also known as pods that are pendulous, brown, triangular, and split into three sections when dried. They can range in length from 20 to 60cm In the months of March and April are when fruits are most commonly produced. In their early stages of development, fruit contain about 26 seeds.¹⁸

Geographical Distribution

Geographical Distribution of Brahmi plant:

Typically, this plant thrives in moist soil. It is primarily present in Nations like Nepal, Sri Lanka, China, Taiwan, India, Florida, Pakistan, Vietnam, and the Southern part of The US. It is mostly found in tropical climates in India¹⁹⁻²²

Geographical Distribution of Ashwagandha Plant:

It is grown in gardens in the warmer regions of Europe and is now a weed in South Australia and New South Wales. But in India, it is cultivated mostly for its fleshy roots, which are rich in bioactive chemicals with a variety of therapeutic implications.²³⁻²⁵ In the drier regions of India, the plant is widely dispersed, particularly in Punjab, Gujarat, Uttar Pradesh, Maharashtra, West Bengal, and Rajasthan.²⁶

Geographical Distribution of Moringa Oleifera Plant

M. oleifera is extensively distributed throughout the world, but it is native to India, Arabia, and the East Indies. Asia, Africa, the Caribbean, Latin America, the Pacific Islands, Florida, Madagascar,

Central America, Cuba, the Philippines, Ethiopia, and Nigeria are among the regions where it is prevalent.²⁷⁻²⁸ It grows well in direct sunlight, without standing water, and in slightly acidic to alkaline soil. At 6 to 8 months of age, the tree starts to yield fruit.²⁹

Chemical Constituents

Chemical Constituents of Brahmi Plant:

Bacopamonnieri contains alkaloids, brahmine, and herpestine as its chemical components. The main phytochemicals listed are terpenoids and saponins.³⁰ Bacoside A contains nitric oxide, which allows the arteries and veins to lighten in order to enhance the blood flow more easily throughout the body, making this significant plant a nootropic medicine, Bacosides A and B have been found to improve memory.³¹

Chemical Constituents of Ashwagandha Plant

Alkaloids (isopelletierine, anaferine, cuseohygrine, anahygrine, etc.), steroidal lactones (withanolides, withaferins), and saponins are some of *Withania somnifera*'s (WS) biologically active chemical components.³² 5-dehydroxy withanolide-R and withasomniferin-A were produced by *Withaniasomnifera*'s aerial portions.³³

Chemical Constituents of Moringa Oleifera Plant

Plants produce a class of secondary metabolites known as glucosinolates.³⁴ Important health-promoting qualities have been discovered for both glycosylates and isothiocyanates.³⁵ *M. Oleifera*'s dried leaves are a fantastic source of polyphenol substances like flavonoids and phenolic acids.³⁶⁻³⁷ Myrecytin, quercetin, and kaempferol, with concentrations of 5.8,

0.207, and 7.57 mg/g, respectively, are the primary flavonoids detected in MO leaves.³⁸⁻³⁹

Pharmacological Activity

Brahmi plant

1) Anti-Inflammatory Activity

Bacopa monneri can modulate the release of proinflammatory mediators. The extract of triterpenoids and bacosides is beneficial in treating a variety of inflammatory diseases.⁴⁰⁻⁴¹

2) Neuro-Pharmacological activity

Memory enhancer in Alzheimer's disease and Schizophrenia:

The alcohol-based Bacosides A and B extract improves the brain's capacity for learning. The hippocampus's protein kinase activity has been shown to be enhanced by BM.⁴²⁻⁴⁴

3) Anti-Oxidant Activity

The lipid peroxidation impact is inhibited by the anti-oxidant qualities seen in the alcoholic and hexane components of B. monneri. Other academic research also demonstrated the antioxidant activity of B. monneri through other ways. i.e., by preventing the activity of the enzymes superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPX), Nitric oxide (NO), which is utilised in treating many disorders like AD and ischemia, is reduced in the methanolic extract, which helps to reduce the concentration of superoxide anion.

4) Anti-Asthmatic Activity:

The tracheal muscle may relax when exposed to B. Monneri extract. Bronchial dilation is another benefit. The antagonistic effects of carbachol-induced effects on inspiratory and expiratory stress may reflect the plant's bronchodilator property.

5) Anti-Cancer Activity:

The ethanolic extract of the B. monneri plant contains bacosides A and B that have antitumor properties. This plant contains cucurbitacins, which have been shown to have potent anti-tumorigenic and anti-proliferative properties.

6) Anti-Convulsive Activity:

It has been documented in numerous scientific investigations that B. Monneri crude water extract suppresses epilepsy. A sedative is produced by the plant extract. It is well recognized that drugs that stimulate the neurotransmitter GABA have anticonvulsant, analgesic, and sedative effects.

7) Anxiolytic Effect

Since this plant does not cause amnesia and also has memory-improving properties in addition to its anxiolytic effect, it offers significant advantages over lorazepam (LZP).

8) Hepatoprotective Activity

According to the research that was mentioned, testing on albino mice revealed that the ethanolic extract of B. monneri contains a compound called bacoside that has hepatoprotective properties. The serum marker enzymes and LPO increase are both prevented in part by bacoside A.

9) Cardiovascular Activity

The plant's ethanolic extract has cardiovascular benefits. By making the left ventricle contract, it keeps the blood flowing. It also has the ability to protect the aorta and respiratory system

Ashwagandha Plant

1) Anti-Cancer Activity:

Studies have revealed that a number of chemicals extracted from Ashwagandha's root, stem, and leaves have anti-cancer qualities. As a result, they can be used either alone or in conjunction with other chemotherapeutic drugs to treat cancer.⁴⁵

2) Anti-Aging Activity

In a double-blind clinical trial, ashwagandha was evaluated for its anti-aging abilities. 101 healthy guys between the ages of 50 and 59 were administered the herb daily at a dose of 3 gram for a whole year. The participants' haemoglobin levels, red blood cell count, hair pigmentation, and seated stature all significantly improved.⁴⁶

3) Anti-Oxidant Activity

Due to their abundance in lipids and iron, two substances known to play significant roles in the production of reactive oxygen species, the brain and nervous system are relatively more vulnerable to free radical damage than other tissues. Normal ageing and neurodegenerative illnesses, such as epilepsy, schizophrenia, Parkinson's, Alzheimer's, and other conditions, may be accompanied by free radical damage to nerve tissue. Superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPX) levels in the rat brain frontal cortex and striatum were used to test the antioxidant activity of the active principles

of WS, sitoindosides VII-X and withaferina (glycowithanolides). Reduced activity of these enzymes causes harmful oxidative free radicals to build up and cause degenerative consequences.

Increased antioxidant activity and a protective effect on neural tissue would be represented by an increase in these enzymes. Once daily for 21 days, active glycowithanolides of WS were administered; dose-related increases in all enzymes were noticed; the increases were equivalent to those seen with the administration of deprenyl (a well-known antioxidant). This suggests that WS does, in fact, have an antioxidant effect on the brain, which could account for its varied pharmacological properties. Another study examined the impact of an aqueous suspension of WS root extract on stress-induced lipid peroxidation (LPO) in mice and rabbits. Lipopolysaccharides (LPS) from *Klebsiella pneumoniae* and peptidoglycans (PGN) from *Staphylococcus aureus* both raised the blood levels of LPO. Oral WS extract was administered simultaneously to prevent a rise in LPO.

4) Anti-stress effect:

A prospective, double blind, randomized, placebo-controlled study was conducted on 64 participants for 60 days to determine the safety and effectiveness of a high-concentration full-spectrum extract of Ashwagandha roots to lessen stress and anxiety. Each capsule in the research medicine treatment group included 300 mg of high-concentration full-spectrum extract from Ashwagandha root. When compared to the placebo group, the treatment group's ratings on all of the stress-assessment scales significantly decreased (P0.0001).

Compared to the placebo group, the Ashwagandha group's serum cortisol levels were significantly lower ($P=0.0006$). According to the study, a high-concentration full-spectrum Ashwagandha root extract safely and successfully increases a person's resistance to stress, which in turn enhances self-assessed quality of life.

In a different clinical study, participants who were randomly assigned to receive standardised WS root and leaf extract (WSE) (125 mg QD, 125 mg BD, or 250 mg BID) or a placebo were examined for the impact of the treatment. Using a modified Hamilton anxiety (mHAM-A) scale, stress levels were measured at days 0, 30, and 60. Days 0 and 60 saw measurements of biochemical and clinical indicators. There were 130 participants, and 98 finished the study. Between days 0 and 60, the WSE 125 mg QD group experienced a substantially greater decrease than the placebo group in the mean mHAM-A score, serum cortisol, serum C-reactive protein, pulse rate, and blood pressure. Consuming WSE has no negative effects while dramatically reducing both experience and biological stress.

5) Anti-Inflammatory/ Immunomodulatory Effects:

Withania somnifera is being investigated for the treatment of numerous conditions like diabetes, cancer, and neurological illnesses that are linked to inflammation in the body, as well as cardiovascular, pulmonary, and autoimmune diseases. Inhibiting inflammatory markers including cytokines (including IL-6 and TNF- α), nitric oxide, and reactive oxygen species has been shown to help this plant regulate mitochondrial activity and apoptosis while also reducing inflammation in preclinical trials.

Meanwhile, a potential inhibitory effect of Ashwagandha root powder was shown in nephritis and proteinuria in a mouse model of lupus. Ashwagandha's effectiveness in treating rheumatic conditions is also being researched. In a study using an animal model, rats were given *Withania somnifera* root powder orally for three days, beginning an hour before CFA (complete Freund's adjuvant) was injected into the body to cause inflammation. Rats in the positive control group (control group) received phenylbutazone treatment. Along with a considerable decrease in inflammation, changes in the amounts of a variety of serum proteins, including prealbumin, acute phase protein 1 and 2 glycoprotein was seen.

6) Anti-Diabetic Activity:

Type 1 and Type 2 diabetes have both been found to be cured by moringa. Patients with type 1 diabetes do not produce insulin, a hormone that is necessary to keep blood glucose levels at the desired normal range. Insulin resistance is one that is connected to type 2 diabetes. Beta cell malfunction, which fails to detect glucose levels and lowers insulin signalling as a result, may also contribute to type 2 diabetes and result in excessive blood sugar levels. Numerous research have demonstrated the anti-diabetic properties of moringa. According to a study, *M. oleifera*'s aqueous extracts can treat rats with both insulin-resistant Type 2 diabetes and Type 1 diabetes caused by streptozotocin. In a different study, the researchers observed a decrease in fasting blood glucose levels after feeding *Moringa* seed powder to STZ-induced diabetes mice. Additionally, the serum levels of antioxidant enzymes rose when the rats were given 500 mg of moringa seed powder per kg of body weight. This demonstrates that the

antioxidants in moringa can reduce the ROS that STZ induction causes in the beta-cells.

Moringa Oleifera Plant

1) Neuro Pharmacological Activity:

Previous studies have demonstrated that leaf extract establishes levels of monoamine in the brain and is very helpful in Alzheimer's disease.⁴⁷⁻⁴⁸

2) Anti-Asthmatic activity:

The therapy of patients with bronchial asthma as well as their contemporaneous respiratory functions improved without exhibiting any negative effects from *M. oleifera* seed kernel.⁴⁹

3) Anti -Viral activity:

The public's health can be seriously threatened by viral infection; hence prevention and treatment are crucial. Studies demonstrate that the ethanolic extract of *M. oleifera* leaves suppressed plaque development in HSV-1 infections and reduced the mortality of HSV-1-infected mice (250 mg/kg/dose), demonstrating its antiviral activity. The amount of HBV cccDNA is dramatically reduced by the aqueous extract of *M. oleifera*, which also suppresses the hepatitis B virus. When administered orally to mice with HSV-1 infections at a dose of 750 mg/kg/day, the ethanolic extract of *M. oleifera* leaves was successful in treating the infection. It considerably slowed the onset of skin lesions, increased the median survival times, and decreased mortality.

4) Anti-diabetic activity:

Type 1 and Type 2 diabetes have both been found to be cured by moringa. Patients with type 1 diabetes do not produce insulin, a hormone that is necessary to keep blood

glucose levels at the desired normal range. Insulin resistance is one that is connected to type 2 diabetes. Beta cell malfunction, which fails to detect glucose levels and lowers insulin signalling as a result, may also contribute to type 2 diabetes and result in excessive blood sugar levels. Numerous research have demonstrated the anti-diabetic properties of moringa. According to a study, *M. oleifera*'s aqueous extracts can treat rats with both insulin-resistant Type 2 diabetes and Type 1 diabetes caused by streptozotocin. In a different study, the researchers observed a decrease in fasting blood glucose levels after feeding Moringa seed powder to STZ-induced diabetes mice. Additionally, the serum levels of antioxidant enzymes rose when the rats were given 500 mg of moringa seed powder per kg of body weight. This demonstrates that the antioxidants in moringa can reduce the ROS that STZ induction causes in the beta-cells.

5) Anti-Cancer activity:

M. oleifera is a natural, dependable, and safe anticancer drug when taken at recommended dosages. The proliferation of cancer cells can be inhibited by using moringa as an anti-neoproliferative drug, according to studies. Leaf extracts that are soluble or solvent-based have demonstrated antitumor effectiveness. In addition, studies contend that cancer's capacity to trigger reactive oxygen species in cancer cells may be the cause of the disease's ability to inhibit cell proliferation. Apoptosis is caused by the reactive oxygen species that are created in the cells, according to research. This is further demonstrated by the apoptotic pathway's caspase 3 and caspase 9 being upregulated.

6) Anti-Asthmatic activity:

The therapy of patients with bronchial asthma as well as their contemporaneous respiratory functions improved without exhibiting any negative effects from *M. oleifera* seed kernel.

7) Anti-Pyretic Activity:

Different extracts (ethanol, petroleum ether, and ethyl acetate, etc.) were used to test the antipyretic effect of *Moringa* in rats, and the seed extracts (ethanol and ethyl) shown a substantial amount of activity.

Medicinal Uses

Use of Brahmi plant

1. This plant's leaves are used to treat cough, colds, and nasal congestion. As an eye drop, the root extract is used to treat cataracts, and the leaves are used to treat asthma and constipation.

2. This plant is used to relieve headaches, either as an oil or a paste. This is also used as an antiseptic.⁵⁰

Use of Ashwagandha plant

The potential health advantages of *Ashwagandha* have attracted more attention in recent years, notably in the areas of stress management, cognitive function, and physical performance. According to several studies, taking *Ashwagandha* supplements may have neuroprotective effects, assist treat obsessive-compulsive disorder, and have anti-inflammatory, immunomodulatory and antibacterial effects.

Supplementing with *ashwagandha* may be beneficial for treating diabetes, cancer, and infertility. According to studies, *ashwagandha* may have cardioprotective effects and be useful for treating sleep disorders.⁵¹

Use of *Moringa oleifera* plant

1. *M. oleifera* is a medicinal herb that has been used for centuries to cure paralysis, helminthiasis, ulcers, and skin problems.⁵²

2. *M. oleifera* is a rich source of trace elements and minerals, as well as a variety of amino acids that are essential to human health. Its nutritious content is the same as what *spirulina* offers.⁵³

Conclusion

The primary traditional plant used in the preparation of numerous Ayurvedic and folk medicines is known as *bacopa monnieri*. It exhibits tremendous promise for improving certain neuropharmacological diseases, aggravation, and other issues.

Ashwagandha, also known as *Withania somnifera*, is a herb that has been utilised in traditional Indian medicine since the time of Ayurveda. Additionally, the plant's numerous pharmacological characteristics, such as antioxidant, anxiolytic, adaptogen, memory-improving, antiparkinsonian, anti-inflammatory, and anticancer capabilities, have been extensively Investigated. This review primarily offers a comprehensive assessment, focusing on *M. oleifera*'s phytochemistry, pharmacology, toxicity, agricultural economy, and dietary benefit aspects as well as its traditional and botanical uses. This study highlights the intriguing biological properties of *M. oleifera*, including its well-known pharmacological action.

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