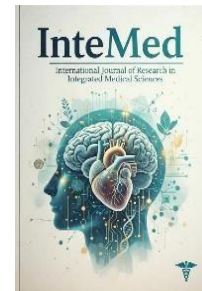




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Review Article

Medhya Rasayanas in Neuroprotection: Bridging Dravyaguna Concepts with Modern Neuropharmacology

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Abstract:Neurodegenerative disorders and age-related cognitive decline present a complex global healthcare burden. Because these pathologies involve multi-factorial cascades—including oxidative stress, neuroinflammation, synaptic dysfunction, and protein aggregation—single-target pharmacological interventions often yield limited disease-modifying benefits. In Ayurveda, cognitive preservation and neurological revitalization are systematically addressed through **Medhya Rasayana**, a specialized class of rejuvenative botanical remedies indicated to enhance memory, intellect, and neurological resilience. This review bridges traditional **Dravyaguna Vigyan** (Ayurvedic pharmacology) with contemporary neuropharmacology. Through the classical *Rasa Panchaka* framework—encompassing *Rasa* (taste), *Guna* (physicochemical attributes), *Veerya* (potency), *Vipaka* (post-digestive effect), and *Prabhava* (specific dynamic

action)—*Medhya Dravyas* are understood to alleviate *Vata* dysregulation, balance *Sadhaka Pitta*, and nourish *Majja Dhatu* (nervous tissue). Modern empirical studies corroborate these classical principles, demonstrating that key phytoconstituents—such as bacosides (*Bacopa monnieri*), withanolides (*Withania somnifera*), asiaticosides (*Centella asiatica*), and glycyrrhizin (*Glycyrrhiza glabra*)—readily cross the blood-brain barrier. These bioactives exert multi-target neuroprotection by upregulating Brain-Derived Neurotrophic Factor (BDNF), modulating cholinergic and GABAergic neurotransmission, suppressing NF- κ B-mediated neuroinflammation, activating Nrf2 antioxidant defense pathways, and inhibiting acetylcholinesterase. By mapping traditional Ayurvedic pharmacodynamics onto modern cellular pathways, this review highlights the therapeutic potential of *Medhya Rasayanas* as integrative, multi-target

neuroprotective agents for age-related cognitive impairment and neurodegenerative diseases.

Keywords

Medhya Rasayana • Dravyaguna Vigyan • Neuroprotection • Rasa Panchaka • Neuropharmacology • Phytotherapy • Cognitive Enhancement • Ayurvedic Pharmacology

Introduction

Neurodegenerative disorders and cognitive impairment represent one of the most significant global healthcare challenges of the 21st century. Pathologies such as Alzheimer's disease, Parkinson's disease, vascular dementia, and age-related cognitive decline are driven by complex multifactorial mechanisms, including chronic neuroinflammation, excessive oxidative stress, mitochondrial dysfunction, synaptic loss, and abnormal protein aggregation. While conventional neuropharmacology has made notable strides in managing specific symptoms, many single-target pharmacotherapies yield limited long-term disease-modifying benefits and are often accompanied by undesirable adverse effects. Consequently, there is growing interest in multi-target, holistic therapeutic frameworks capable of offering sustained neuroprotection and cognitive enhancement.

In Ayurveda, the science of cognitive health is systematically conceptualized under the umbrella of **Medhya Rasayana**—a specialized sub-branch of *Jara Chikitsa* (geriatrics and rejuvenation science). The term *Medhya* denotes substances that enhance intellect, memory, and cognitive capacity (*Medha*), while *Rasayana* refers to therapies that nourish the fundamental tissues (*Dhatus*), enhance vital essence (*Ojas*), and promote longevity. Classic Ayurvedic treatises, including the *Charaka Samhita* and *Sushruta Samhita*, detail several cornerstone *Medhya Dravyas*, notably *Mandukaparni* (*Centella asiatica*), *Yastimadhu* (*Glycyrrhiza glabra*), *Guduchi* (*Tinospora cordifolia*), and *Sankhapushpi* (*Convolvulus pluricaulis*), alongside potent neuroactive herbs like *Brahmi* (*Bacopa monnieri*) and *Ashwagandha* (*Withania somnifera*).

From the foundational perspective of **Dravyaguna Vigyan** (Ayurvedic pharmacology), the neuroprotective efficacy of these botanical agents is understood through their unique *Rasa Panchaka*—the multi-dimensional pharmacodynamic profile comprising *Rasa* (taste), *Guna* (physicochemical attributes), *Veerya* (potency), *Vipaka* (post-digestive effect), and *Prabhava* (specific dynamic action). Ayurvedic literature posits that *Medhya Dravyas* work primarily by balancing *Vata Dosha* (which governs neurological functions) and *Sadhaka Pitta* (which governs psychological and emotional processing), while promoting *Agni* (metabolic integrity) at the cellular tissue level (*Dhatu Agni*).

Modern neuropharmacology has increasingly validated these ancient observations. Phytochemical characterization of *Medhya Rasayanas* reveals a rich diversity of bioactive compounds—such as bacosides, withanolides,

asiaticosides, and glycyrrhizin—that readily cross the blood-brain barrier. Contemporary empirical studies demonstrate that these bioactives exert neuroprotective effects via diverse mechanisms: upregulating neurotrophic factors such as Brain-Derived Neurotrophic Factor (BDNF), modulating neurotransmitter systems (cholinergic, GABAergic, and glutamatergic pathways), suppressing pro-inflammatory cytokines (TNF- α , IL-1 β), scavenging reactive oxygen species (ROS), and promoting neurogenesis and synaptic plasticity. Bridging the paradigm of *Dravyaguna* with modern neuropharmacology provides a robust, integrative framework for drug discovery and therapeutic optimization. This review aims to comprehensively evaluate key *Medhya Rasayanas* by mapping their classical Ayurvedic principles (*Rasa, Guna, Veerya, Vipaka, and Prabhava*) onto contemporary neuroprotective mechanisms, establishing an evidence-based bridge between traditional wisdom and modern neuroscience.

Objectives

1. To explain how traditional Ayurvedic brain herbs (*Medhya Rasayanas*) work using modern brain science.
2. To show how the four core herbs (*Mandukaparni, Yashtimadhu, Guduchi, and Shankhapushpi*) reduce brain stress, protect nerve cells, and improve memory.
3. To look at how these herbs help different age groups, including children with attention issues, adults with stress, and elderly people with memory loss.
4. To explain why taking these herbs with healthy fats like milk or ghee helps them absorb better into the brain.

Material and Methods

1. **Literature Search Strategy** A systematic literature search was conducted across major electronic databases, including PubMed, Scopus, Google Scholar, ScienceDirect, and AYUSH Portal, covering studies published up to 2026. The search utilized combinations of classical and contemporary keywords.
2. **Classical Textual Analysis** Primary classical Ayurvedic treatises—specifically the *Charaka Samhita* (*Chikitsa Sthana*, Chapter 1), *Sushruta Samhita*, and *Bhavaprakasha*—were critically reviewed to extract original descriptions of *Medhya Dravyas*, their pharmaceutical forms (*Swarasa, Kalka, Churna*), classical indications, and traditional pharmacodynamics (*Rasa, Guna, Veerya, Vipaka, Prabhava*).

MEDHYA RASAYANAS^{[1][2]}

The four core *Medhya Rasayanas* of Acharya Charak—*Mandukaparni, Yashtimadhu, Guduchi, and Shankhapushpi*—each possess distinct pharmacological profiles and neuro-biochemical mechanisms of action.

Mandukaparni (*Centella asiatica*)^{[3][4][5]}

Mandukaparni (*Centella asiatica*) relies on active triterpenoids such as asiaticoside, madecassoside, and asiatic acid. Its primary pharmacological properties include neuroprotective, microcirculatory, antioxidant, and anxiolytic actions. In terms of its mode of action, Mandukaparni stimulates brain-derived neurotrophic factor (BDNF) to promote neurite outgrowth and dendritic arborization in the hippocampus. It inhibits acetylcholinesterase to increase synaptic acetylcholine levels, improves microvascular perfusion to optimize cerebral oxygenation, and scavenges reactive oxygen species while maintaining endogenous glutathione levels.

Yashtimadhu (*Glycyrrhiza glabra*)^{[6][7]}

Yashtimadhu (*Glycyrrhiza glabra*) functions through bioactives like glycyrrhizin, glabridin, liquiritigenin, and isoliquiritigenin. Pharmacologically, it exhibits anti-inflammatory, anti-apoptotic, adaptogenic, and nootropic properties. Its mode of action involves suppressing neuroinflammation by inhibiting NF- κ B, PGE₂, and COX-2 signaling pathways in glial cells. It protects against glutamate-induced excitotoxicity by blocking excessive intracellular calcium influx into neurons. Furthermore, it regulates cortisol degradation by inhibiting 11β -hydroxysteroid dehydrogenase type 1, while its classical administration with warm milk utilizes lipids as a carrier to facilitate crossing the blood-brain barrier.

Guduchi (*Tinospora cordifolia*)^{[8][9]}

Guduchi (*Tinospora cordifolia*) utilizes diterpenoid lactones and alkaloids like tinosporoside, cordifolioside A, and berberine. Its pharmacological profile centers on immunomodulation, neuro-cytoprotection, adaptogenic stress regulation, and metabolic detoxification. Its mode of action revolves around regulating microglial activation to suppress chronic low-grade neuroinflammation. Guduchi activates the Nrf2 pathway to upregulate endogenous antioxidant enzymes including superoxide dismutase, catalase, and glutathione peroxidase. Additionally, it modulates central monoamine levels—balancing dopamine, serotonin, and norepinephrine—and clears metabolic waste cellular debris from neural tissues.

Shankhapushpi (*Convolvulus pluricaulis*)^{[10][11]}

Shankhapushpi (*Convolvulus pluricaulis*) contains active alkaloids and coumarins including shankhapushpine, convolvine, and scopoletin. Charak designates it as the superior herb among the four due to its potent anxiolytic, anti-amnesic, neuroprotective, and sedative pharmacological properties. Its primary mode of action is driven by GABA-A receptor modulation, enhancing central GABAergic tone to lower neuronal excitability without disrupting memory processing. It normalizes hyperactive Hypothalamic-Pituitary-Adrenal axis signaling to decrease serum cortisol levels, increases ribosomal protein synthesis to enhance long-term potentiation for memory consolidation, and protects neural tissue against ischemia-induced injury.

Effects of Medhya Rasayan on Neurological Disorders Neurodegenerative Disorders^{[12][13]}

Medhya Rasayana herbs target progressive cognitive decline and neural loss in Alzheimer's disease, Parkinson's disease, and age-related dementia. Active triterpenoids like asiaticoside inhibit the formation and aggregation of toxic amyloid-beta plaques within the hippocampus. Simultaneously, these botanicals act as natural acetylcholinesterase inhibitors, slowing the breakdown of acetylcholine to preserve clear synaptic signaling. Their potent antioxidant profile neutralizes reactive oxygen species, protecting mitochondrial membranes, mitigating lipid peroxidation, and halting premature neuronal cell death.

Mood and Anxiety Disorders^{[14][15][16]}

For conditions like generalized anxiety, chronic workplace stress, panic disorders, and depression, these herbs regulate the central neuro-endocrine axis. Botanicals such as Shankhapushpi bind to GABA-A receptors to increase central gamma-aminobutyric acid activity, suppressing hyperactive neuronal firing to calm the mind without heavy sedation. Additionally, they suppress hyperactivation of the Hypothalamic-Pituitary-Adrenal axis, leading to a direct reduction in elevated serum cortisol and adrenaline. This process balances central serotonin, dopamine, and norepinephrine levels to elevate mood and build resilience against chronic burnout.

Pediatric and Neurodevelopmental Conditions^[17]

In pediatric conditions such as ADHD, learning disabilities, short-term memory deficits, and speech delays, Medhya Rasayanas enhance structural brain plasticity. They elevate levels of Brain-Derived Neurotrophic Factor and encourage dendritic arborization, allowing neurons to establish stronger synaptic connections. Herbs such as Vacha increase nerve signal conduction speed in brain areas dedicated to speech processing and executive focus, directly improving attention span, cognitive processing speed, and academic retention.

Endocrine-Driven Psychological Stress^[18]

In endocrine-driven psychological conditions, particularly menopausal syndrome and premenstrual mood distress, Medhya Rasayanas buffer the central nervous system against sharp hormonal fluctuations. Drops in estrogen levels often disrupt neurotransmitter stability, triggering severe anxiety, brain fog, and emotional volatility. These formulations normalize central neurochemistry during hormonal transitions, stabilizing mood, reducing autonomic hyper-arousal, and preventing the emotional disruptions associated with menopausal transitions.

Sleep Disorders and Mental Exhaustion^{[19][20]}

For sleep disorders, chronic insomnia, and post-illness mental fatigue, these herbs restore healthy sleep architecture and clear neural metabolic waste. Grounding botanicals like Jatamansi quiet central nervous system excitability, allowing brain wave activity to transition smoothly into deep, restorative alpha and theta states. At the cellular level, they assist in clearing metabolic debris and lipofuscin accumulation from brain tissue, reversing mental fatigue and restoring day-time cognitive sharpness.

Classical Preparations and Vehicles (*Anupana*)^{[21][22]}

The vehicle (*Anupana*) used to take these herbs plays a critical biochemical role. Lipids like cow's ghee (*Ghrita*) or warm cow's milk act as bio-transporters that help active botanical compounds cross the blood-brain barrier effectively.

1. Powders (*Churna*)

- **Administration:** Taken post-meals with warm milk, warm water, or honey.
- **Classical Example:** Charak prescribes Yashtimadhu Churna strictly with warm cow's milk to balance its heating/cooling properties and optimize neural absorption.

2. Fresh Juices (*Swarasa*) and Pastes (*Kalka*)

- **Administration:** Taken on an empty stomach in the morning for maximum metabolic absorption.
- **Classical Example:** Mandukaparni and Guduchi are traditionally given as freshly extracted juices (*Swarasa*), while Shankhapushpi is given as a fine whole-plant paste (*Kalka*).

3. Medicated Ghee (*Siddha Ghrita*)

- **Administration:** Administered early in the morning on an empty stomach or before bed. Liposomal transport via ghee makes this the most potent delivery method for chronic neurodegenerative conditions.
- **Classical Formulations:** *Brahmi Ghrita*, *Kalyanaka Ghrita*, and *Saraswata Ghrita*.

4. Decoctions (*Kwatha*) and Syrups

- **Administration:** Taken post-meals. Palatable sugar-based syrups are frequently used in pediatric populations to ensure compliance.

Discussion

The combination of ancient Ayurvedic knowledge and modern brain science gives us a fresh way to protect the brain and improve memory. Most modern medicines focus on fixing just one chemical or problem at a time. However, conditions like Alzheimer's disease, chronic stress, and age-related memory loss are complicated and involve many problems happening at once—such as inflammation, cell damage, stress, and poor communication between brain cells. *Medhya Rasayanas* work well because they act as multi-purpose remedies, targeting many of these problems at the same time without causing harsh side effects.

In Ayurveda, memory loss and brain fatigue happen when the body's nervous system tissue (*Majja Dhātu*) loses its balance and nourishment. The four main herbs highlighted by Acharya Charak work together in different ways to restore this balance, which modern science can explain through brain chemistry:

- **Mandukaparni (*Gotu Kola*):** Rebuilds and repairs brain connections. It boosts a essential brain growth protein (BDNF) that helps the brain adapt and learn new things, while keeping key memory chemicals active for longer.
- **Yashtimadhu (*Licorice*):** Calms brain inflammation and shields nerve cells from stress damage. Taking it with warm milk helps its active healing components cross directly into the brain.
- **Guduchi (*Giloy*):** Acts as a brain cleanser and immunity booster. It activates the body's natural

antioxidant defense system to clear out cellular waste and protect brain cells from toxic buildup.

- **Shankhapushpi:** Relaxes an overactive mind. It works directly on the brain's calming receptors (GABA) to reduce stress hormones like cortisol, helping lower anxiety, improve sleep, and sharpen concentration.

These herbs are helpful across all stages of life. Clinical studies show they help children improve attention span and short-term memory, assist women in managing emotional mood swings during menopause, and help older adults slow down memory loss caused by dementia.

However, even though these herbs show great promise, there is still a gap between traditional use and modern hospital practices. Most research studies done so far have used small groups of people. To make these natural therapies widely accepted in modern medicine, we need larger, high-quality clinical trials and standardized manufacturing methods to guarantee consistent quality and dosage in every batch.

Conclusion

Medhya Rasayanas offer a proven, natural way to protect brain health and improve memory. By matching ancient Ayurvedic principles with modern science, we can see that these herbs protect the brain by reducing stress, calming inflammation, repairing nerve connections, and balancing brain chemicals.

Using traditional methods like taking herbal powders with healthy fats like milk or ghee helps the body absorb these natural compounds directly into the brain. While current studies strongly support their benefits for children, adults, and the elderly, future research must focus on larger human trials to standardize these remedies. Embracing these multi-target herbs can lead to safer, more holistic treatments for stress, memory loss, and brain aging worldwide.

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