ISSN: 3107-6513

Concept of Medhya Rasayana and Its Role in Cognitive Health: A Comprehensive Review

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Abstract

Cognitive health is essential for maintaining memory, learning and decision-making abilities. The global rise in neurodegenerative disorders such as Alzheimer's disease and dementia has increased the demand for effective and safe therapeutic strategies. Ayurveda describes *Medhya Rasayana* as a group of rejuvenative drugs that enhance intellect (*Dhi*), retention (*Dhriti*) and memory (*Smriti*). Classical texts identify four primary *Medhya Rasayana* drugs—*Mandukaparni* (*Centella asiatica*), *Yashtimadhu* (*Glycyrrhiza glabra*), *Guduchi* (*Tinospora cordifolia*) and *Shankhapushpi* (*Convolvulus pluricaulis*). These herbs exhibit neuroprotective, antioxidant and adaptogenic properties. Modern research supports their role in modulating neurotransmitters, reducing oxidative stress and enhancing neurogenesis. This review explores the Ayurvedic concept, pharmacology, and scientific evidence supporting Medhya Rasayana in cognitive health.

***Keywords*:** *Medhya Rasayana, Mandukaparni* (*Centella asiatica*), *Yashtimadhu* (*Glycyrrhiza glabra*), *Guduchi* (*Tinospora cordifolia*) and *Shankhapushpi* (*Convolvulus pluricaulis*).

1. INTRODUCTION

Cognitive health refers to the brain's ability to process information, retain memory, and perform intellectual functions. The increasing prevalence of neurodegenerative disorders such as Alzheimer's disease, dementia, and age-related cognitive decline has become a major global concern. According to the World Health Organization, neurological disorders significantly contribute to global disability and mortality (World Health Organization, 2022[i]).

Modern pharmacological treatments provide limited benefits and often focus on symptomatic relief rather than addressing the root cause of cognitive decline (Aguiar & Borowski, 2013[ii]). This limitation has led to increased interest in traditional systems such as Ayurveda, which emphasize holistic and preventive approaches.

Ayurveda conceptualizes cognition through *Dhi*, *Dhriti*, and *Smriti*, governed by *Sattva*, *Rajas* and *Tamas* (Sharma & Dash, 2018; Tripathi, 2017[iii]). Among these, *Sattva* is essential for clarity and intelligence. The concept of *Medhya Rasayana* specifically targets cognitive enhancement by promoting mental balance and nourishing the nervous system

Medhya Rasayana is a poly herbal formulation widely used in *Ayurvedic* clinical practice with multi fold benefits, specifically to improve memory and intellect by their *Prabhava* (specific action) namely *Medhya* (Nootropic).[iv] *Medhya Rasayana* are group of medicinal plants described in *Ayurveda* (Indian system of medicine) with multi-fold benefits, specifically to improve memory and intellect by *Prabhava* (specific action). Medha means intellect and/or retention and *Rasayana* means therapeutic procedure or preparation that on regular practice will boost nourishment, health, memory, intellect, immunity and hence longevity. *Medhya Rasayana* is a group of four medicinal plants that can be used singly or in combinations. They are *Mandukaparni* (*Centella asiatica*), *Yastimadhu* (*Glycirrhiza glabra*), *Guduchi* (*Tinospora cordifolia*) and *Shankhapushpi* (*Convolvulus pleuricaulis*.)[v]

Medhya Rasayanaare used either in polyherbal preparations or alone. This paper is an attempt to present update on these drugs. Evidences used are mostly facts from researches on animal model or on bioactive principles with some of preclinical works on human system.

ISSN: **3107-6513**

2. CONCEPT OF MEDHYA RASAYANA

Medhya Rasayana refers to drugs that enhance intellectual functions. According to *Charaka Samhita*, these drugs improve: Dhi (learning ability), Dhriti (retention), Smriti (memory)

They act by enhancing *Sattva guna*, nourishing *Majja Dhatu*, and promoting *Ojas* (Lad, 2002[vi]; Sharma & Dash, 2018[vii]).

2.1 Classical Medhya Rasayana Drugs

Herb Name	Botanical Name	Family
Mandukparni	*Centella asiatica*	Apiaceae
Yastimadhu	*Glycyrrhiza glabra*	Fabaceae
Guduchi	*Tinospora cordifolia*	Menispermaceae
Shankhapushpi	*Convolvulus pluricaulis*	Convolvulaceae

2.2 Rasapanchka of *Medhya Rasayana* Drugs

Herb Name	Rasa	Guna	Veerya	Vipaka	Part used
Mandukparni	Tikta, kashaya Madhura	Laghu, Sara	Sheeta	Madhura	Whole plant
Yastimadhu	Madhura	Guru, Snigdha	Sheeta	Madhura	Root
Guduchi	Tikta, Kashaya	Guru, Snigdha	Ushna	Madhura	Stem
Shankhapushpi	Tikta	Snigdha, Pichila	Sheeta	Madhura	Whole plant

2.3 Phytoconstituents and Pharmacological Actions of *Medhya Rasayana* Drugs

Herb Name	Major Phytoconstituents	Pharmacological Actions
Mandukparni	Asiaticoside, Madecassoside, Brahmoside, Brahminoside	Nootropic, Memory enhancer, Neuroprotective, Anxiolytic, Wound healing
Shankhapushpi	Convolvine, Shankhapushpine, Scopoletin, Kaempferol	Anxiolytic, Sedative, Antidepressant, Memory enhancing
Guduchi	Tinosporin, Berberine, Cordifolioside, Tinosporide, Diterpenoids	Immunomodulatory, Neuroprotective, Adaptogenic, Antipyretic, Anti-inflammatory, Antioxidant, Hepatoprotective
Yastimadhu	Glycyrrhizin, Liquiritin, Glabridin, Flavonoids	Neuroprotective, Anti-ulcer, Anti-inflammatory, Expectorant, Adaptogenic

3. PHARMACOLOGICAL DETAILS OF INDIVIDUAL DRUGS

3.1 *Shankhapushpi* (*Convolvulus pluricaulis* Choisy)

Several studies have scientifically validated the neuropharmacological and therapeutic potential of Shankhapushpi (*Convolvulus pluricaulis* Choisy). Sethiya et al. (2009)[viii] reported its effectiveness in anxiety, neurosis, insomnia and cerebral abnormalities, highlighting its role as a nervine tonic and memory enhancer. Bihaqui et al. (2009)[ix] showed neuroprotective effects of aqueous extract against aluminium chloride-induced neurotoxicity in rat cerebral cortex. Further, Bihaqi et al. (2012)[x] demonstrated attenuation of scopolamine-induced elevation of tau protein, amyloid

ISSN: **3107-6513**

precursor protein (AβPP), amyloid β levels and associated histopathological changes, suggesting anti-Alzheimer potential. Liu et al. (2011) reported that *C. pluricaulis* extract reduced Amyloid β generation by modulating APP processing in N2a-SwedAPP cell lines.Verma et al. (2012) established significant antioxidant and anticonvulsant activities, while Nahata et al. (2008) demonstrated enhancement of learning behaviour and memory in rodents. Agarwal et al. (2014) comprehensively reviewed the medicinal and pharmacological importance of *C. pluricaulis*. Nath et al. (2022) further explored the role of omega-3 fatty acids present in the plant in improving learning and memory. Sethiya and Mishra (2010) compiled extensive ethnomedical and pharmacological evidence demonstrating nootropic, anxiolytic, antidepressant, anti-inflammatory, antioxidant, antidiabetic and neuroprotective properties of the plant, and also highlighted clinical evidence supporting its traditional use as a brain tonic. Recently, Hannan et al. (2022) demonstrated the protective mechanism of *C. pluricaulis* in dementia, whereas Melloni et al. (2023) reported its glycemic balancing potential in adipose cell models.

Mechanism

Shankhapushpi acts by enhancing GABAergic activity and reducing cortisol levels. It improves synaptic transmission and promotes memory consolidation (Gupta & Verma, 2014[xi]).

3.2 *Mandukaparni* (*Centella asiatica* Linn.)

Recent studies on Mandukaparni (*Centella asiatica* Linn.) have extensively demonstrated its neuroprotective, cognition-enhancing and therapeutic potential. Rao et al. (2006)[xii] suggested that its anti-seizure activity may occur through modulation of ATPase activity and enhancement of dendritic arborization associated with learning and memory. Visweswari et al. (2010) [xiii] demonstrated that *C. asiatica* inhibits scopolamine-induced memory impairment through acetylcholinesterase inhibition. Doknark et al. (2014)[xiv] reported improvement in learning and memory deficits induced by transient bilateral common carotid artery occlusion in mice. Prakash and Kumar (2013)[xv] reported multiprotective effects against aluminium-induced neurotoxicity, including improved memory performance, oxidative defense, mitochondrial enzyme activity and reduced acetylcholinesterase activity, apoptosis and aluminium concentration in rats. Hanapi et al. (2016) [xvi] evaluated the blood-brain barrier permeability of *C. asiatica* extract supporting its neuroprotective potential, while Yogeswaran et al. (2016)[xvii] updated its neuroprotective and neuroregenerative activities. Omar et al. (2019)[xviii] reported enhanced neural differentiation of human mesenchymal stem cells in vitro. More recently, Bandopadhyay et al. (2023)[xix] reviewed the therapeutic and pharmacological significance of phytochemicals such as asiaticoside and madecassoside present in *C. asiatica*.

Mechanism

Mandukaparni acts by inhibiting acetylcholinesterase, thereby increasing acetylcholine levels in the brain. It also promotes dendritic growth and enhances brain-derived neurotrophic factor (BDNF), which supports neurogenesis and synaptic plasticity (Orhan, 2012[xx]).

3.3 *Guduchi* (*Tinospora cordifolia* (Willd.) Miers)

Recent investigations on Guduchi (*Tinospora cordifolia*) have demonstrated significant neuroprotective, adaptogenic and cognition-enhancing activities. Reddy et al. (2015)[xxi], Sharma et al. (2019) [xxii]and Ahsan et al. (2023)[xxiii] comprehensively reviewed the phytochemical composition and diverse pharmacological properties of *T. cordifolia*, highlighting the presence of alkaloids, diterpenoid lactones, glycosides, steroids, phenolics and polysaccharides responsible for its therapeutic effects. Kosaraju et al. (2014)[xxiv] reported neuroprotective effects of ethanolic extract in experimental Parkinsonism models. Mishra and Kaur (2013)[xxv] demonstrated the differentiation-based therapeutic potential of aqueous extract against glioblastoma cells. Singh et al. (2021)[xxvi] reported that *T. cordifolia* ameliorated obesity-associated brain dysfunction, while Mishra et al. (2016)[xxvii] showed improvement in anxiety-like behaviour and cognitive impairment in sleep-deprived rats. Sharma and Kaur (2018)[xxviii] demonstrated neuroregenerative potential against glutamate-induced

ISSN: **3107-6513**

excitotoxicity. Archana et al. (2022) reported neuroprotective activity against streptozotocin-induced neuropathic pain in experimental models.[xxix]

Mechanism

Guduchi enhances antioxidant enzymes such as superoxide dismutase and catalase. It also modulates the immune-neuro axis and reduces neuroinflammation, thereby protecting brain cells (Upadhyay et al., 2010[xxx]).

3.4 *Yashtimadhu* (*Glycyrrhiza glabra* Linn.)

Recent studies on Yashtimadhu (*Glycyrrhiza glabra* Linn.) have demonstrated remarkable neuroprotective, cognition-enhancing and pharmacological activities. Noreen et al. (2021)[xxxi] comprehensively described the traditional and medicinal importance of *G. glabra* in managing inflammatory disorders, liver diseases, gastric ulcer, respiratory ailments and immunodeficiency conditions. Experimental studies have shown that aqueous extract of *Glycyrrhiza glabra* possesses significant antihypoxic and antioxidant effects in sodium nitrite-induced hypoxia in rats and improves learning and memory in scopolamine-induced dementia models. Luo et al. (2014)[xxxii] demonstrated that glycyrrhizin exerts neuroprotective effects against kainic acid-induced neuronal cell death in mice through suppression of gliosis and inflammatory mediators such as COX-2, iNOS and TNF-α. Chowdhury et al. (2013)[xxxiii] reported anticonvulsant and antioxidant effects of aqueous and ethanolic extracts in pentylenetetrazole-induced seizure models in albino rats. Kim et al. (2012)[xxxiv] further demonstrated neuroprotective effects of glycyrrhizin in post-ischemic rat brain after middle cerebral artery occlusion through anti-inflammatory, anti-excitotoxic and antioxidative mechanisms. Zhu et al. (2010)[xxxv] identified 2,2',4'-trihydroxychalcone from *G. glabra* as a potent BACE1 inhibitor capable of ameliorating memory impairment in mice, indicating anti-Alzheimer potential. More recent reviews by Sharma et al. (2018)[xxxvi], Ahmed-Farid et al. (2019), Sharma et al. (2021) and Wahab et al. (2021) elaborated the chemistry, pharmacology and dose-dependent neuroprotective potential of glycyrrhizin and other phytoconstituents of *G. glabra*.

Mechanism

Yashtimadhu reduces neuronal damage by scavenging free radicals and modulating neurotransmitter systems. It also exhibits anti-inflammatory effects, protecting neurons from degeneration (Dhingra et al., 2004[xxxvii]).

5. INTEGRATED MECHANISM OF MEDHYA RASAYANA

Medhya Rasayana drugs exert their effects through multiple pathways:

- **Cholinergic modulation:** Enhances acetylcholine levels, improving memory (Aguiar & Borowski, 2013[xxxviii])
- **Antioxidant activity:** Reduces oxidative stress and neuronal damage (Sairam et al., 2002[xxxix])
- **Neurogenesis:** Promotes neuronal growth via BDNF
- **Stress reduction:** Modulates cortisol and HPA axis (Chrousos, 2009[xl])
- **GABA modulation:** Reduces anxiety and improves mental clarity

6. ROLE IN COGNITIVE DISORDERS

Medhya Rasayana is beneficial in managing Alzheimer's disease, dementia, stress-induced cognitive decline, anxiety disorders. These herbs improve cognitive performance and protect against neurodegeneration (Rao et al., 2005,[xli] Singh et al., 2010[xlii]).

7. CONCLUSION

Medhya Rasayana constitutes a cornerstone of Ayurvedic therapeutics for enhancing cognitive health and preventing neurodegenerative disorders. The four principal Medhya Rasayana drugs—Mandukaparni, Yashtimadhu, Guduchi, and

ISSN: **3107-6513**

Shankhapushpi—demonstrate significant neuroprotective, antioxidant, adaptogenic, and memory-enhancing properties, which are supported by both classical Ayurvedic literature and modern scientific research.

These herbs exert their effects through multiple mechanisms, including modulation of neurotransmitter systems, reduction of oxidative stress, enhancement of neurogenesis, and regulation of the hypothalamic-pituitary-adrenal (HPA) axis. Such a multi-target approach is particularly advantageous in complex disorders like Alzheimer's disease and dementia, where multiple pathological processes are involved.

In addition to their pharmacological benefits, Medhya Rasayana drugs offer a holistic approach by improving mental clarity, emotional stability, and overall quality of life. Their ability to enhance *Sattva guna* and promote mental equilibrium makes them especially relevant in managing stress-related cognitive impairments in modern society.

Despite these promising attributes, the integration of Medhya Rasayana into mainstream healthcare requires further validation through rigorous clinical trials, standardization of formulations, and mechanistic studies at the molecular level.

In conclusion, Medhya Rasayana holds immense potential as a safe, effective, and holistic therapeutic strategy for cognitive enhancement and neuroprotection. Its integration with modern medical science may pave the way for the development of novel, multi-target therapies for cognitive disorders, thereby contributing significantly to global healthcare.

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