



## REVIEW ARTICLE

# MEMORY AND INTELLIGENCE ENHANCERS PRESCRIBED IN AYURVED AS MEDHYA DRVYA: REVIEW UPDATE

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Access this article online: www.jahm.in

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Received on: 02/06/14, Revised on: 18/06/14, Accepted on: 24/06/14

## ABSTRACT

In present era there is so many drugs are available in market as memory enhancers as well as intelligence enhancers. But the main thing has to consider that some of them are having great adverse effect. To reduce the adverse effect and getting boosting effect of drug, Ayurveda is the only solution. Ayurveda provides a list of herbs known for *medhya* activity as well as their multi-dimensional utility in various conditions. This paper is to update the knowledge of *medhya dravya* on pharmacological properties, major chemical constituents, therapeutic actions, preclinical studies, safety and possible mode of action. Concurrently, it opens up for further research and standardization on *medhya dravyas*.

**Keywords:** Ayurveda, intelligence enhancer, Memory enhancer, *Medhya dravya*

## INTRODUCTION

In Ayurveda there are so many drugs are used as memory and intelligence enhancers. Some of them are as *Aindri* (*Bacopa monniera*), *Guduchi* (*Tinospora cordifolia*), *Jatamamsi* (*Nardostachys jatamamsi*), *Jyothishmati* (*Celastrus panniculata*), *Mandukaparni* (*Centella asiatica* Linn.), *Shankhapushpi* (*Convolvulus pleuricaulis* Chois), *Vacha* (*Acorus calamus*), *Yastimadhu* (*Glycyrrhiza glabra* Linn.) there are so many more but in this paper we discuss on this eight drugs on evidence base. These drugs are worked on the concept of *Prabhava* (specific action). *Medhya dravyas* are used alone or in different combinations in ayurvedic classical texts. 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.

## Scientific facts

*Aindri* (*Bacopa monniera*) commonly called as *Brahmi* belongs to Scrophulariaceae family. <sup>[1]</sup> It is a small, creeping marshy herb grown throughout India <sup>[2]</sup>. Most beneficial therapeutic form is macerated whole plant juice. Properties are said to be similar to that of *Mandukaparni*. <sup>[3]</sup> *Bacopa monniera* is a well-known nootropic plant reported for its tranquilizing, <sup>[4]</sup> hepatoprotective, <sup>[5]</sup> memory enhancer <sup>[6]</sup> sedative action, <sup>[7]</sup> cognitive enhancer, <sup>[8]</sup> and antioxidant actions. <sup>[9-11]</sup> Neuroprotective activity may be ascribed to having its reactive oxygen species scavenging property. <sup>[12]</sup> *Bacopa monniera* is a saponin rich plant. <sup>[13]</sup> Bacosides are

the main active nootropic principle present in the alcoholic extract of the plant.<sup>[14]</sup>

Guduchi (*Tinospora cordifolia* (Wild) Miers) is a large glabrous, deciduous, climbing shrub of Menispermaceae family found throughout tropical India.<sup>[15]</sup> Juice of whole plant is used therapeutically as *Medhya*. It is also used in the form of decoction, powder and *Satwa* (starch extract of stem). Its root is known for its anti-stress, anti-leprotic and anti-malarial activities.<sup>[16-17]</sup>

Chemical constituents' classes are alkaloids, diterpenoid lactones, glycosides, steroids, sesquiterpenoid, phenolics, aliphatic compounds and polysaccharides.<sup>[18]</sup> Neuroprotective and ameliorative properties are due to their antioxidant and trace element contents.<sup>[19]</sup> *Tinospora cordifolia* is known to be a rich source of trace elements (Zinc and Copper) which act as antioxidants and protects cells from the damaging effects of oxygen radicals generated during immune activation.<sup>[20]</sup> It increases the blood profile and has lead scavenging activity.<sup>[21]</sup> *Tinospora cordifolia* has been claimed to possess learning and memory antioxidant,<sup>[22-23]</sup> enhancing,<sup>[24]</sup> and anti-stress activity.<sup>[25]</sup> *Tinospora cordifolia* enhanced the cognition in normal and cognition deficits animals in behavioral test Hebb William maze and the passive avoidance task.<sup>[26]</sup> Mechanism of cognitive enhancement is by immunostimulation and increasing the synthesis of acetylcholine, this supplementation of choline enhances the cognition.<sup>[27]</sup> Myriad actions of Guduchi may be attributed to its antioxidant<sup>[28-29]</sup> and immunomodulatory properties.<sup>[30]</sup>

*Jatamansi* (*Nardostachys jatamansi*) is an erect perennial aromatic herb with long, stout, woody, grayish, rhizomatous, tail-like rootstock covered

with reddish-brown hairs or tufted fibrous remains of the petioles of withered radical leaves<sup>[31]</sup>, and belongs to Valerianaceae family. Rhizome is used for medicinal purposes as it is *Bhutaghna* or *Manasa Doshahara* (relieves of psychiatric problems) and *Medhya*.<sup>[32]</sup> Roots and rhizomes of *N. jatamansi* are used to treat hysteria, epilepsy, and convulsions.<sup>[33]</sup> The decoction of the drug is also used in neurological disorders, insomnia and disorders of cardiovascular system.

<sup>[34]</sup> Rhizomes contain a terpenoid ester, nardostachysin I.<sup>[35]</sup> It is proven to improve learning and memory in mice<sup>[36]</sup> and also to enhance biogenic amine activity.<sup>[37]</sup> An acetone extract of *N. jatamansi* has shown significant inhibition of benzoyl peroxide-induced cutaneous oxidative stress, toxicity, and ear edema in mice.<sup>[38]</sup> *Jyotishmati* (*Celastrus panniculata*) is a large, woody, climbing shrub with ovate or obovate leaves found all over India. Seeds are yellowish, ellipsoid or ovoid enclosed in a scarlet aril,<sup>[39]</sup> Seed oil (*Jyotishmati Taila*) is known for *Medhya* action.<sup>[40]</sup> This oil contains several terpenoids like paniculatadiol, b-sitosterol, celastrol, b-amyrin, pristimerin, but its most investigated components are its many sesquiterpenoids, dihydroagarofuran-type polyols or esters.<sup>[41]</sup> *Celastrus paniculata* showed antioxidant activity by decreasing the lipid peroxidation<sup>[42]</sup> and anti-arthritis activity in rat model.<sup>[43]</sup> Seed oil of *Celastrus panniculata* (*Malkangni*) reversed scopolamine-induced deficits in navigational memory task in young adult rats.<sup>[44]</sup>

*Mandukaparni* (*Centella asiatica* Linn.) is a prostrate, stoloniferous perennial herb rooting at nodes.<sup>[45]</sup> Fresh whole plant juices is used for therapeutic purposes as *Medhya* (cognitive

enhancer).<sup>[46]</sup> Major constituents are saponin (medacoside, asiaticoside, medacassoside, asiatic acid, a new triterpenic acid.<sup>[47]</sup> They act on behavior besides being neuroprotectives<sup>[48]</sup> brain growth promoter.<sup>[49]</sup> Dendritic arborization is supposed to be the neuronal basis for improved learning and memory.<sup>[50]</sup> Anti-seizure activity may result from direct or indirect modulation of ATPase activity.<sup>[51]</sup> *Centella asiatica* inhibits the memory impairment induced by scopolamine through the inhibition of AChE.<sup>[52]</sup> Methanol extract of *Centella asiatica* showed highest free radical scavenging activity that can be attributed to the presence of polyphenols and flavonoids as this fraction contains maximum amount of these secondary metabolites (0.07 mg/ml). It also exhibited DNA damage protection activity on pRSETA plasmid DNA in TE buffer (10 mM Tris-Cl and 1 mM EDTA) pH 8.0. Chloroform extract of *Centella* showed highest poly phenolic activity followed by methanol extracts (9.04 µg/mg, 7.7 µg/mg, 6.76 µg/mg Gallic acid equivalents respectively); while flavinoids were abundant in water extracts, followed by chloroform extracts. These two namely poly phenols and flavinoids are responsible for potent anti oxidant and terminate free radicals.<sup>[53]</sup> BR-16A (Mentat), a formulation containing *Centella asiatica* proved for its antistress effects.<sup>[54]</sup> Extracts of *Centella* are used in a herbal cosmetic cream for the improvement of skin viscoelasticity and hydration.<sup>[55]</sup> A study was conducted on Menotab, an effective herbomineral preparation containing *Centella asiatica* with other drugs from the Himalaya drug company, Bangalore. Study showed that Menotab is an ideal medication for relief of postmenopausal symptoms as a short-term therapy.<sup>[56]</sup> Administration

of *Centella asiatica* at 1,000 mg/kg b.wt for a period of 30 days in albino rats, showed organ specific toxicity.<sup>[57]</sup>

*Shankhapushpi* (*Convolvulus pleuricaulis* Choisy) is a perennial, prostrate or sub erect spreading hairy herb,<sup>[58]</sup> found throughout India.<sup>[59]</sup> Recommended therapeutic form is fine paste of whole plant. Highly regarded as *Medhya* (intellect promoter).<sup>[46]</sup> Important chemical principles are microphyllic acid, shankhapushpin, kaempferol-kaempferol-3-glucoside, 3, 4 dihydroxycinnamic acid, sitosterols. Neuroprotective and intellect promoting activity implicated to free radical scavenging and antioxidant property.<sup>[60]</sup> BR-16A (Mentat), a poly herbal combination containing *Shankhapushpi* significantly reversed the social isolation stress-induced prolongation of onset and decrease in pentobarbitone-induced sleep, increased total motor activity and stress-induced antinociception in experimental model.<sup>[61]</sup> Ayushman-8 (containing *Shankhapushpi*, *Brahmi* and *Vacha*) reported to be effective on *Manasa-mandata* (mental retardation).<sup>[62]</sup> *Shankhapushpi* compound containing *Shankhapushpi*, *Sarpagandha*, and *Gokshura* in equal quantities studied to be effective in *Chittodvega* (anxiety disorders).<sup>[63]</sup> Sanjay Parsania<sup>[64]</sup> reported *Shankhapushpi* to be effective in relieving signs and symptoms of *Chittodvega* (anxiety disorders). Herbalists believe that *Shankhapushpi* calms the nerves by regulating the body's production of the stress hormones, adrenaline and cortisol.<sup>[65]</sup> *Convolvulus pleuricaulis* whole plant extract, shows the highest inhibitory activity against *Helicobacter muridarum*.<sup>[66]</sup> Few investigations reports that *Shankhapushpi* has potent depressive action in mice.<sup>[67]</sup>

*Vacha (Acorus calamus)* of Araceae family is a semiaquatic, perennial, aromatic herb with its rhizome being horizontal, rounded, somewhat vertically compressed, spongy and leaves grass like and sword shaped; grown all over India [68]. Active chemical principles are  $\alpha$ -asarone, elemicine, cis-isoelemicine, cis and trans isoeugenol and their methyl ethers, camphene, P-cymene, bgurjunene, a-selinene, b-cadinene, camphor, terpinen-4-ol, a-terpineol and a-calacorene, acorone, acrenone, acoragermacrone, 2-deca-4,7 dienol, shyobunones, linalool and preisocalamendiol. Acoradin, galangin, 2, 4, 5-trimethoxy benzaldehyde, 2,5-dimethoxybenzoquinone, calamendiol, spathulenol and sitosterol are also present [69-71]. Rhizome is useful part having *Medhya* quality. It has been used in Indian and Chinese system of medicine for hundreds of years to cure diseases especially the central nervous system (CNS) abnormalities. [71-74]

*Yastimadhu (Glycyrrhiza glabra* Linn.) is a hardy herb or under shrub belonging to Fabaceae family. [75] Fine powder of dried root is used internally with milk for therapeutic purpose as *Medhya*. Active ingredients are isoflavones, six phenolic compounds. [76] glycyrrhetic acid, [77] glycyrrhizine, flavonones, [78] Multidimensional activities of *Yastimadhu* may be attributed to glycyrrhizine and flavonones. *Yastimadhu* is cytotoxic and its prolonged use may lead to pseudoaldosteronism, [79] hyperkalemia, [80] and hypertension. [81-82] The roots and rhizomes of *G. glabra* has been studied with respect to spatial learning and passive avoidance [83] preliminary free radical scavenging [84] cerebral ischemia [85] and antioxidant capacity towards LDL oxidation. [86] *Glycyrrhiza glabra* aqueous extract markedly improves anti-hypoxic effects induced by sodium

nitrite in rats and this effect may be mediated by its antioxidant properties. [87-88] Liquorice has significant action on memory enhancing activity in dementia [89] it significantly improved learning and memory on scopolamine induced dementia. The roots and rhizomes of *Glycyrrhiza glabra* is an efficient brain tonic; it increases the circulation into the CNS system and balance the sugar levels in the blood. [90]

## CONCLUSION

For current requirement of memory and intelligence enhancers this update for the *Medhya dravyas* may be very useful. Though there is much more research need to give any conclusion, this little scientific facts may help for prescribing our *medhya dravyas*. Still we need to think as per our classical texts.

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**Cite this article as:** Sandip G Buddhadev, Sheetal S Buddhadev. Memory and intelligence enhancers prescribed in ayurved as medhya drvya: review update. *J of Ayurveda and Hol Med (JAHM)*;2014;2(6):47-54

Source of support: Nil, Conflict of interest: None Declared