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A BIRD EYE REVIEW ON BRAHMI *(BACOPA MONNIERI* (LINN.)) A MEDICINAL HERB IN NEUROLOGICAL DISORDERS

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ABSTRACT

The plant *Bacopa monnieri* (Linn.) named as *Brahmi*, is a small and perennial creeping annual plant belonging to Scrophulariaceae family. Bramhi has been applied in Ayurveda since many generations as a nerve tonic and treatment of neurological disease. In the 16th century *Bacopa* is recommended in Ayurvedic text (*Charaka Samhita*) for the treatment of wide range of mental illness. It has such an incredible effect on neurological disorders that its work satisfies as its name after Lord *Brahma*, the legendary creator of Hindu Pantheon. Each chemical component in *Brahmi* has its own significant role in neuroprotection. The estimated annual market demand of *B. monnieri* was estimated at 1000 tons for the year 2000 and reported by Board of National Medicinal Plants. *B. monnieri* helps in preventing the breakdown of acetylcholine to help in memory enhancement by acting on its cognitive and related brain function. The current literature review emphasizes the effect on Psychiatric and neurological disorders of *Brahmi*.

KEY WORDS: *Ayurveda*, *Brahmi*, Neurological diseases, *Medhya.*

INTRODUCTION

Brahmi (*Bacopa monnieri* Linn.) belongs to the family Scrophulariaceae. The three *Doshas* viz *Vata*, *Pitta* and *Kapha* are the basic principles of *Ayurveda*. Together these *doshas* govern all metabolic activities. When they go slightly out of balance, we may feel uneasy. The predominance of *Vata dosh* generates neurological disorders hence there is requirement of drugs that targets stabilization of the "*Vata*" component in the body. Neurological

degenerative diseases are characterised by metabolic disturbances, vascular diseases, nutritional deficiencies or infection and pathologically by progressive loss of CNS neurons and their processes accompanied by fibrillary astrocytosis.[1] *Brahmi* is first mentioned in the very first verse of the third chapter of *Athar Samhita* (800 BC) in *Ayurveda*. Its importance is also found in other ancient classical Ayurvedic treatises, viz., *Charak Samhita*, *Susurutu Samhita*, *Astanga hrdaya* for the promotion of memory, intelligence and general performance. The significance of *Brahmi* (Bacopa monniera Linn.) in improving memory and learning skills was first published in 1982.[2] Indian Government's Central Drug Research Institute, Lucknow (CDRI 08) also launched a special extract of *Brahmi* (*Bacopa monnieri* Linn.) in 1996.

Brahmi contains bacoside A (64.28%), bacoside B (27.11%), betullic acid, D-mannitol, β-sitosterol and stigmastanol. Bacoside A is levo-rotatory and bacoside B is dextro-rotatory. Bacoside A contain two sets of saponins. One set was derived from pseudojujubogenin, which upon acid hydrolysis furnishes four triterpenoid transformation products, viz., Bacogenins A1, A2,A3 and A4.[3,4] A wide varierty of researche's report found that Bacopa monnieri Linn. contain pharmacological active constituent saponins (bacosides A & B, bacopaside, or bacopasaponins) which have the properties of mind-sharpening, neuroprotective, anti-epileptic, anti-anxiety, sedative, anti-amnesic.[12,13] The aim of this literature review of an article on Brahmi is to draw attention on better understanding of its efficacy on neurological disoders in human beings.

Taxonomic classification

Kingdom- Plantae

Division- Magnoliophyta

Class- Magnoliopsida

Sub class- Asteridae

Order- Scrophulriales

Family- Scrophulariaceae

Genus- Bacopa

Species- Bacopa monnieri

Vernacular names[5]

Hindi- Manduka Parni

English- Thyme Leaved Gratiola

Assamese- Brahmi

Urdu- Brahmi

Gujarati- Neerbrahmi, Bamanevari

Kannada- Nirubrahmi, Valabrahmi, Ondelaga, Mandukaparni.

Malayalam- Bhahmi

Marathi- Jalnam, Brahmi, Birami

Oriya- Brahmi

Punjabi- Brahmibuti

Tamil- Nirabrahmi, Brahmi vazhukkai

Telugu- Sambarenu, Sambarani

Botanical description

Brahmi(Bacopa monneri Linn.) is a small and perennial creeping annual plant belonging to Scrophulariaceae family, is at elevations from sea level to altitudes of 4,400 feet. It grows naturally in wet soil, shallow water, marshes and easily cultivated if adequate water is available. Flowering and fruiting are in summer.[6] Stems are 10-30 cm long, arise from creeping stems that form roots at the nodes. Leaves are simple, obovate-oblong, opposite, approximately 2cm × 1cm, with entire margins. Flowers are blue or white with purple veins, solitarily on long pedicles in the leaf axils. The corolla is five lobed, white or pinkish with purple blotches. The fruit is an upto 5mm capsule, which develops in the persistent calyx.[7,8]

Chemical constituents[9]

Major- Bacoside A and alkaloid brahmine, nicotinine and herpestine is also present.

Others- Bacoside B, Bacoside A_1, Bacoside A_3, Bacogenin A_1, Bacogenin A_2, Bacogenin A_3, Bacogenin A_4, Bacopasaponin-C, Bacopasides I&2, Bacopasides 3-5, Bacopasides 6-8, bacobitacins A-D, Monnieraside 1, monnieraside 3, monnierin, plantioside B, jujubogenin, pseudojujubogenin, 3-O-[β-D-glucopyranosyl-(1 3)- β-D-glucopyranosyl] jujubogenin, 3-O-[β-D-glucopyranosyl-(1 3)- β-D-glucopyranosyl] pseudojujubogenin, betulinic acid,

wogonin, oroxindin, luteolin, luteolin-7-glucoside, luteolin-7-glucuronide, apigenin-7-glucuronide; nicotine, 3-formyl-4-hydroxy-2H-pyran, bacosine, bacosterol, bacosterol-3-O-β-D-glucopyranoside, stigmasterol, stigmastanol, β-sitosterol, D-mannitol and an uncharacterized glycoside.

Pharmacological effects

Rasa- Tikta, Kasaya, Madhura

Guna- Laghu, Sara

Virya- Sheeta

Vipaka- Madhura

Karma- Vatahara, Kaphahara, Rasayana, Medhya, Ayusya, Prajasthapana, Matiprada, Svarya, Visahara, Mohahara.[10]

In *Bhavaprakasha nighantu*, *Brahmi* (*Bacopa monnieri* Linn.) is *Tikta*, *Kasaya* and *Madhura* in *rasa*, *Sheeta* in *veerya*, *Madhura* in *vipaka*, having properties of *Rasayana* and memory booster, also effective in skin diesease, anemia, diabetes, blood disorders, cough, swelling, fever. In *Dhanvantari nighantu* (*Karveeradi varg*), *Brahmi* is S*heeta* in *veerya*, *Tikta* in *rasa*, beneficial for swelling, anaemia, fever, itching, skin disease and liver disease. In R*aj nighantu* (*Parpatadi varg*), *Brahmi* (*Hydrocotyle assatics* Linn.) is *Sheeta* in *veerya*, *Kasaya* in *rasa*, *Tikta* in *vipaka*, beneficial in gout, *pitta* dominant diseases, effective in mental disorders and rejuvinating. *Raj nighantu* also mentioned *Laghu Brahmi*. In *Kayadeva nighantu* (*Aousadhi varg*), *Brahmi* (Centella asiatica Linn.) Urban., syn. Hydrocotyle asiatica Linn.) is considered as *Rasayana*, having *Tikta*, *Kasaya* and *Madhura rasa*, *Madhura vipaka* and S*heeta veerya*. *Acharya Priyavrat sharma* called *Aendri* as Bacopa monnieri and *Brahmi* is the synonym of *Mandukaparni* called Centella asiatica. In *Nighantu adarsha*, *Brahmi ghrita* is useful in epilepsy and hysteria. According to *Bhavprakash nighantu*, the *churna* of its leaves are beneficial in mental disorders.

Modern researches

Medhya Rasayana- *Brahmi* (Bacopa monnieri Linn.), *Sankhpuspi* (Convolvulus pluricaulis), *Yasti* (Glycyrrhiza glabra) and *Guduchi* (Tinospora cordifolia) are considered as *Medhya Rasayana* in *Ayurveda*. These four drugs are tested in normal and stressed rats on the level of Ach, catecholamine, 5-HT and histamine content of brain. The results obtained are the Ach content in the cortex was increased but decreased in the whole brain homogenate whereas the level of catecholamine and 5-HT contents were increased, the histamine content was

decreased in the whole brain homogenate but increased in the cortex. These changes were more pronounced in stressed rats. These evidences showed Brahmi have a transquilizing effect and its significant role in improving mental function.[11]

Anticonvulsant activity- A study was done at different time intervals of ethanolic extract of *Brahmi* with a dose of 100mg/kg bw on the cerebral amino acid, gamma-aminobutyric acid (GABA), glutamate and glutamine of albino rats. The elevated level of glutamate showed anticonvulsant activity of the plant.[14] In another study, epileptic rats were given the herbal medication and hypoxia induced rats were given glucose, oxygen and epinephrine. The results showed that Brahmi treatment significantly reversed the downregulation of mGluR8 gene to normal level. Similarly, glucose supplementation together with oxygen supply in hypoxic neonates rescued the NMDAR1 gene expression to normal level. These observations revealed a neuroprotective role of Brahmi in glutamate-mediated excitotoxicity during seizures in pilocarpine-induced epilepsy.[15]

Antidepressant activity- During an experiment in comparision with anti-depressant drug fluoxetine hydrochloride, Bacopa monnieri extract (80 and 120 mg/kg) showed impressive effect on reducing escape latency and plasma corticosterone level in rats. The extract had an advantage of having better antidepressant activity over fluoxetine hydrochloride.[16] The methanolic extract of Bacopa monnieri (20 and 40 mg/kg) orally once daily for 5 days showed significant anti-depressant activity on comparing with anti-depressant drug imipramine (15 mg/kg) on rodents.[17]

Anti anxiety- A study was done in 35 cases of anxiety neurosis. Brahmi was givsen for a month in the dose of 30 ml per day in two divided doses (representing 12 g of the dry crude drug). Besides reduction in the level of anxiety, there was a fall in the level of urinary vinyl mandellic acid (VMA) and corticoids.[18] In an experiment of immobilization stress, the result was found that the increased level of plasma corticosterone and level of monoamines (NA, 5-HT and DA) was significantly reduced by Bacopa monnieri at oral doses of 40 and 80 mg/kg, in cortex and hippocampus regions of the brain in rats similiar to the effects of Panax quinquefolium (positive cotrol), commonly known as American ginseng, at oral doses of 100mg/kg. In the acute stress model, Bacopa monnieri reduced the level of 5-HT and DA but ineffective in normalizing nordrenaline (NA) levels in the cortex and hippocampus regions of the brain in rat, in the other hand, Panax quinquefolium attenuated all assayed neurochemical effects. In the chronic stress model, Bacopa monnieri and Panax quinquefolium significantly

increased the levels of NA, DA and 5-HT levels in cortex and levels of NA and 5-HT in hippocampus regions.[19]

Antiparkinson- Bacopa monnieri, on pharmacological Caenorhabditis elegans models of Parkinson's, reduced alpha synuclein aggregation, prevents dopaminergic neurodegeneration and restores the lipid content in nematodes, thereby proving its potential as a possible anti-Parkinsonian agent.[20] Another study on the effectiveness of Bacopa monieri on aggregation of alpha-synuclein, dopamine (DA) neuron degeneration, lipid profile and longevity in a transgenic and pharmacologically induced 6-hydroxydopamine (6-OHDA) Parkinson disease (PD) model in Caenorhabditis elegans.[21]

Anti-Epileptic- A study showed the effect of Bacopa monnieri on Gamma amino butyric acid (GABA) binding and gene expression in cerebral cortex region of epiletic rats. Bacopa monnieri and bacoside-A treatment were beneficial in temporal lobe epilepsy, a common epileptic syndrome.[22] In an experiment on epileptic rats, Bacopa monnieri extract reported beneficial for the glutamate mediated excitotoxicity occuring during seizures and cognitive damage along with pilocaroine induced epilepsy.[23]

Memory promoting action- Forty school going children from rural area in varanasi was being observed for three months. One group was given "brahmi'' syrup (350mg), three times a day and other group was given syrup 'Simplex' as placebo in the same dose. The study showed renovation and improvement of the perceptual motor functions during the development phase in the group receiving 'brahmi'.[24] Another study on the standardized extract (bacoside A) from the plant exhibited dose related anxiolytic action in rats as qualitatively comparing from the standard benzodiazepine anxiolytic, Lorazepam. Brahmi showed memory promoting action without inducing amnesia, therefore Brahmi showed better results than Lorazepam.[25]

Antistroke effects- An investigation was made on Brahmi by ischemic induced brain injury in experimental mice. The result obtained was Brahmi reduced the infarct size and attenuated their short-term memory and motor balance.[26] Further investigations also found that on administrating Brahmi at a dosage of 120, 160 and 240 mg/kg, infract size reduced in the ischemic brain and Brahmi also improved the muscle corrdination and catalase activity in rats, whereas decreased in the level of nitrite, nitrate and rate of lipid peroxidation.[27]

CONCLUSION AND RESULTS

Neurological problems such as anxiety, depression, Alzheimer disease, Parkinson's disease, dementia and many other disorders are very common nowadays. *Bacopa monnieri* has a vastly used in neurological disorders since ancient times. The failure of handling neurological problems properly without any side effect of the drug, raises the demand of use of *Bacopa monnieri*. The presence of chief chemical entity, bacoside A, is responsible for its effectiveness in neurological problems. There is still a lot of researches required to find the targeted activity of the bioactive compounds in the bacoside fraction isolated from *Bacopa monnieri*. There are many things about Brahmi in Ayurvedic texts that should be followed by clinical studies for the welfare of mankind.

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