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AN AYURVEDIC LITERATURE REVIEW ON BRAHMI *(BACOPA MONNIERI L)*

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ABSTRACT: According to World Health Organization, traditional medicine is defined as "the sum total of knowledge, skills and practices based on the theories, beliefs and experiences of different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses." Brahmi (Bacopa monnieri L) is a perennial herb and its name is derived from word "Brahma," the Hindu god, referred to as "the Creator" within the trinity of supreme divinity that includes Vishnu and Shiva. The use of Brahmi in neurological disorders has become popular over the last few decades. The properties and mode of action of Brahmi are therefore being studied intensively in the past few years. Brahmi finds its first reference in Charak Samhita; a popular and ancient Ayurveda literature which is still considered gold standard for practice of Ayurvedic medicine. This article is an attempt to compile references of Brahmi found in Ayurvedic classical texts; which are scattered throughout history. This paper also focuses on numerous properties of Brahmi; mentioned both in Ayurvedic science and modern science along with its action seen on humans.

KEYWORDS: Brahmi, Ayurveda, Neuroprotection, Bacopa, Alzheimer's, Stress

INTRODUCTION:

Brahmi (Bacopa monnieri L) is a perennial herb and its name is derived from word “Brahma,” the Hindu god, referred to as "the Creator" within the trinity of supreme divinity that includes Vishnu and Shiva. (Anon n.d.). Its antiquity can be traced to the time of *Athar Ved* (the science of well-being) written in 800 BC where *Bacopa* finds a mention in the very first verse of the third chapter of *Athar Samhita* (compilation on the factors promoting well-being). (Stough, Singh, and Zangara 2015)

According to World Health Organization, traditional medicine is defined as “the sum total of knowledge, skills and practices based on the theories, beliefs and experiences of different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses.” *B monnieri*, otherwise known as Brahmi and Aindri (Sanskrit) is classified into the Scrophulariaceae family and found throughout the Indian subcontinent in moist soil, humid, and muddy environments. The genus *Bacopa* has 146 aquatic herbal species dispersed throughout the subtropical regions of the globe, including Nepal, India, Sri Lanka, Taiwan, China, and Vietnam, as well as Florida and other US southern regions.(Abdul Manap et al. 2019)

The first documentation of Brahmi was done in 1931, when Bose and Bose reported the isolation of the alkaloid "*Brahmin*" from *Bacopa monnieri* (BM) and other alkaloids like nicotine and herpestine have also been reported later. It was found highly toxic, when administered at a dose of 0.5 mg/kg body weight of cat. (Kapil Deo and Krc 2013)

The use of Brahmi in neurological disorders has become popular over the last few decades. The properties and mode of action of Brahmi are therefore being studied intensively in the past few years. Examinations conducted so far have revealed that Bacopa monnieri exerts numerous pharmacological goods including memory boosting effect in the treatment of Alzheimer Disease and Schizophrenia, besides displaying antiparkinsonian, anti-stroke, and anticonvulsant capabilities.

The extract of Brahmi and its isolated valuable therapeutic agents have been extensively investigated for their nootropic effects, antioxidant, antimicrobial properties, and analgesic activity, etc. These traditional pharmacological claims have been bolstered by large-scale research and clinical studies. Although Brahmi is progressively being used in modern science for treatment of CNS (Central Nervous System) disorders; its application is already being practised by Ayurvedic scholars for centuries. Brahmi finds its first reference in Charak Samhita; a popular and ancient Ayurveda literature which is still considered gold standard for practice of Ayurvedic medicine. Subsequent references of Brahmi are found in various Ayurvedic texts. This article is an attempt to compile references of Brahmi found in Ayurvedic classical texts and research studies conducted on Brahmi in recent times.

DESCRIPTION:

TABLE NO. 1 VERNACULAR NAMES: (GRATIOLA AND PARNI N.D.) (SHAILJA CHOUDHARY ET AL. 2021)

English	Water hyssop, Indian pennywort, Thyme Leaved Gratiola
Sanskrit	Nir-brahmi, Brahmi, Aindri
Gujarat	Neerbrahmi, Bamanevari
Hindi	Brahmi, adha birni, Jal-brahmi, Sarasvati, Mandukaparni

Kanada	Nirubrahmi, Valabrahmi, Ondelaga, Mandukaparni
Telugu	Sambranichettu
Malyalam	Barna, Bhahmi
Marathi	Ghola, Jalnam, Brahmi, Brahmi

TABLE NO. 2 TAXONOMICAL CLASSIFICATION:

Scientific Name	Bacopa monnieri L.
Common Name	Water hyssop, Brahmi
Kingdom	Plantae
Sub kingdom	*Tracheobionta*
Super division	*Spermatophyta*
Division	*Tracheophyta*
Class	*Magnoliopsida*
Sub class	*Asteridae*
Family	Scrophulariaceae
Order	Lamiales
Genus	Bacaopa
Species	B. monnieri

BOTANICAL DESCRIPTION:

Brahmi was considered highly endangered species in 2010 due to increase demand in pharma industry Ayurveda practice. Current Status (2024)- Least concerned meaning the species is no longer endangered. (wiki) It is a non-aromatic herb found at elevations from sea level to altitudes of 4,400 feet and is easily cultivated if adequate water is available.(Kapil Deo and Krc 2013) The leaves of this plant are succulent, oblong and 4–6 mm (0.16–0.24 in) thick. Its ability to grow in water makes it a popular aquarium plant. It can even grow in slightly brackish conditions. Propagation is often achieved through cuttings.(Daniel 2006) **(**GRATIOLA AND PARNI N.D.**)**

A) MACROSCOPIC

Root - Thin, wiry, small, branched creamish-yellow.

Fragments of dried main roots are cylindrical, about 5 mm in diameter, longitudinally wrinkled, and off-white. (Saremi et al. 2018) (Singh, Singh, and Tiwari 2021)

Stem - Thin, green or purplish green, about 1-2 mm thick, soft, nodes and internodes prominent, glabrous; taste, slightly bitter. (Saremi et al. 2018) (Singh et al. 2021)

Leaf - Simple, opposite, decussate, green, sessile, 1-2 cm long, obovate-oblong; taste, slightly bitter. (Saremi et al. 2018) (Singh et al. 2021)

Flower - Small, axillary and solitary, pedicels 6-30 mm long, bracteoles shorter than pedicels. Pale blue or pinkish white, nearly regular, solitary, axillary. (Saremi et al. 2018) (Singh et al. 2021)

Fruit - Capsules upto 5 mm long, ovoid and glabrous.

B) MICROSCOPIC

Root - Shows a single layer of epidermis, cortex having large air cavities; endodermis single layered; pericycle not distinct; stele consists of a thin layer of phloem with a few sieve elements and isolated material from xylem shows vessels with reticulate thickenings.

Stem - Shows single layer of epidermis followed by a wide cortex of thin-walled cells with very large intercellular spaces; endodermis single layered; pericycle 3 consisting of 1-2 layers; vascular ring continuous, composed of a narrow zone of phloem towards periphery and a wide ring of xylem towards centre; centre occupied by a small pith with distinct intercellular spaces; starch grains simple, round to oval, present in a few cells of cortex and endodermis, measuring 4-14 µ in dia., and 8.0-14.0 x 2.5-9.0 µ in dia. Respectively.

Leaf -Shows a single layer of upper and lower epidermis covered with thin cuticle; glandular hairs sessile, subsidiary cells present on both surfaces; a few prismatic crystals of calcium oxalate occasionally found distributed in mesophyll cells; mesophyll traversed by small veins surrounded by bundle sheath; no distinct midrib present.

Powder - Yellowish-brown; shows xylem vessels with reticulate thickening, glandular hairs, simple, round and oval starch grains, measuring 4-14 µ in diameter.

Table No. 3 IDENTITY, PURITY, AND STRENGTH OF BRAHMI

Foreign matter	Not more than 2 per cent
Total Ash	Not more than 18 per cent
Acid insoluble Ash	Not more than 6 per cent
Alcohol soluble extractive	Not less than 6 per cent
Water soluble extractive	Not less than 15 per cent

DOSE - 1-3 g in powder form

CHEMICAL COMPOSITION:

The bioactive phytochemicals present in this plant include saponins, bacopasides III, IV, V, bacosides A and B, bacosaponins A, B, C, D, E, and F, alkaloids, sterols, betulic acid, polyphenols, and sulfhydryl compounds, which may be responsible for the neuroprotective roles of the plant. Both in vitro and in vivo studies show that these phytochemicals have an antioxidant and free radical scavenging action by blocking lipid peroxidation in several areas of the brain. (Singh and Dhawan 1982)

Constituents – Alkaloids

Properties and action

Rasa: Madhura, Tikta, Kashaya; **Guna**: Laghu, Sara; **Virya**: sheeta; **Vipaka:** Madhura

Karma: Kaphahara, Medhya, Rasayana, Svarya, Vatahara, ViÀahara, ËyuÀya, Matiprada, Prajasthapana, Mohahara.

IMPORTANT FORMULATIONS: Sarasvatarishta (Bhaishajya Ratnavali Rasayan Adhyay), Brahmi Ghrita, Ratnagiri Rasa, Brahmi Vati, Sarasvata Churna, Smritisagar Rasa (Yoga Ratnakar Apasmar Chikitsa)

Therapeutic uses: Kushta, Shofa, Pandu, Jwara, Prameha, Manasvikara (Gratiola and Parni n.d.)

Toxicity:- The LD_{50}s of orally administered bacopa extracts in rats were 5 g/kg (aqueous extract) and 17 g/kg (Roodenrys 2002)

TRADITIONAL USE

Table no . 4 Uses and endemism of *Bacopa monnieri (L.*) (Acharya 2015)

Sl.	Tribal/ Indian Ethnic people	Uses/ Aliments treated	Chemical constituents	Ethinicity and uniqueness
1.	Wayanad dist., Kerala	Dried plant powder given internally for treatment of asthma and epilepsy	Tetracyclin titerpenoids saponins, bacosides A and B, hersaponin, alkaloids viz. Herpestine and brahmine and flavonoids Bacoside- A.	Bacoside-A, an active component of Bacopa monnieri improves the working and reference memory by restoring the alterations in cellular oxidants and antioxidant enzymes in the frontal cortex and hippocampus of postnatally PBDE-209-exposed mice
2.	Golaghat, Dist., Assam	Whole plant- effective in memory		
3.	Kochbihar, West Bengal	Cooked as vegetable		
4.	East Nimar region, M.P,	Leaf extract for relieving cough		
5.	Purandar, Maharashtra	Leaf juice for Menstrual disorders		
6.	Assam	Worm infestations in childeren		
7.	Dang, Gujarat	Diabetes melliatus		

AYURVEDIC REVIEW

CHARAK SAMHITA:- Sanjyasthapana (i.e. the one which revives/ resuscitates a person) is the first gana wherein in brahmi is mentioned. It is however found in its synonym Vayastha and explained in the tika. This is followed by prajasthapan gana where brahmi is one the 10 herbs, capable of promoting reproductive abilities of a person. Viman sthan 8th adhyay categorizes brahmi under shirovirechan gana (that which cleanses the cranial cavity). Sharir sthan mentions brahmi twice. It is beneficial in providing stability to a growing foetus and is also used as a vastra dhupan dravya (use of medicated smoke on clothes) for protection of mother and child from various diseases whose referances can be found in sutrasthan chapter 8.

Rasayan – Aindra rasayan, Indrokta rasayan, Dwitiya Brahma rasayan, medhya rasayan

TABLE NO. 5 DISEASE AND INDICATIONS OF BRAHMI

Disease	Brahmi use
Kushta	Honey and ghee
Unmad	Ingredient of mahapaishacccha ghrita and for siddha ghrita use
Apasmar	Ghrita use, with brahmi and honey
Hikka	Ghrita use
Kasa	Ingredient of triushnadya ghrita

ASHTANG HRIDAYA :- Mentions brahmi as a synonym to mandukparni in patoladi gana. Brahmi is mentioned in the sutra sthan adhyay 29, as a rakshakarma dravya (one which offers protection), which is always to be used in protection of *murdha* (the head). In chikitsa sthan, its reference is found in *bhunimbadi churna* which helps in curing *kushta* (skin diseases).

Uttarsthan, 1st adhyay deals with care and treatment of newborns and infants. The mixture of brahmi and other ayurvedic herbs, mixed with *ghee* and honey is prescribed for strength (physical and mental), strong intellect and better life span. In the same adhyay, brahmi is prescribed as a medicated *ghee* to help protect infants from *graha badha* and *bhootonmada;* also assists in speech, memory and cognitive skills of the infant.

Brahmi ghrita, a popular formulation of brahmi, finds its mention in *unmad chikitsa.* Brahmi ghrita has been proven to not only treat mental disorders like dementia but also prevent them. The use of this medicated ghee is encouraged in all those who have a familial history of psychological disorders.

The juice of brahmi leaves mixed with honey is said to be anti-convulsant.

Barhmi is part of various treatment formulations in the form of kalka(paste of leaves), swarasa(juice of leaves) and churna (fine powder); as a treatment for diseases like Unmad, apasmar, granthi-arbuda-nadivrana.

ASHTANGA SANGRAHA:- The first reference of brahmi in sangraha is found under garbhasthapan mahakashaya meaning it is one of the herbs that facilitate the stabilization of foetus in mother's womb.

Brahmi is also a part of prajasthapan gana (that which promotes conception by purifying doshas from the male and female reproductive systems).

Chikitsa : Kushta (swaras and churna), vata vyadhi, graha badha, unmad (brahmi ghrita), apasmar, netra rog (vartmaroga), visha badha.

Brahmi rasayan yoga is mentioned in rasayana adhyay of uttarsthan.

SUSHRUTSAMHITA:- The foremost reference of Brahmi in Sushrut Samhita is found under sarva hitakar ahar section. Brahmi is mentioned in the tika of this section as a explanation to mandukparni; a type of vegetable.

Brahmi is also mentioned in the tika for

- ropanartha (wound healing) kashaya
- in the list of tikta (bitter taste) varga herbs
- Shaaka (vegetables) varga predominant in tikta(bitter) taste

In Sharir sthan, use of brahmi with ghee for medha vardhan in shirap (breast feeding stage) and annad (full diet) Avastha of small children is stated. (su sha 10/45)

Vydhi chikitsa- Ashmari, kushta, unmad, netrarog (anjanartha), karnarog (puran taila), graha chikitsa , aruchi, apasmar,

Rasayan – Brahmi swaras

TABLE NO. 6 NIGHANTU REFERENCES OF BRAHMI:

Nighantu	**Brahmi referenced as**
Abhidhan Manjirir	Medhajanai, tikta skandha (Botter taste)
Amarkosh	Vayastha (Delays againg)
Ashtang Nighantu	Part of Shyamadi gana Plant derives its name from Lord Brahma

Kaiyadev Nighantu	Describes its properties (Sheeta, sara, medhya, swarya,etc). Also describes the name of diseases it works on (Kushta, kandu, shofa, prameha, etc.))
Dravyaguna sangraha	Prashasta , tikta shaak (bitter vegetable)
Nighantu sheesha	Synonym to shankapushi, categorized as vegetable, resembles to fisheyes.
Madhavdravyaguna	Described as age delaying, nootropic, memory enhancing and used in treatment of psychosomatic disorders.

Nighantu	**Rasa**	**Virya**	**Vipaka**	**Guna**
Bhavprakash	Tikta, kashay, madhura	Sheeta	Madhura	Hima, sara, laghu
Dhanvantarinighantu	Tikta, kashay	Sheeta	--	Soumya, laghu
Kaiyadevnighantu	Tikta, kashya	Sheeta	Swadu	laghu, sara
Madanpalnighantu	Tikta	Sheeta	Madhu	Hima, sara, laghu
Rajnighantu	Kashay, tikta	Sheeta	Madhura	Hima

Nighantu	**Karma**	**Rogaghnta**	**Synonyms**
Bhavprakash Vraga- Gudchyadi	Medhya, ayushya, rasayani, swarya, smrutiprada,	Kushta, pandu, prameha, raktapitta, kasa visha, shotha, jwara.	Kapotvanka, somavalli, Saraswati)
Dhanvantarinighantu (Synonyms -	Deepani, Medhya, swarya, ayushya, smrutiprada	Shofa, pandu, jwara, kushta, kandu, plehavruddhi, kasa. prameha, raktapitta, Varga- Karveeradi	Divyateja, mahaushadhi, kapotvega)
Kaiyadevnighantu	Medhya, swarya, hridya, ayushya, rasayami, matiprada,	Kuhtaghna, kandughna, shofa hara, aruchi, visha hara, kasa shwas hara, prameha raktapitta and pandu	--

Madanpalnighantu Varga- Abhayadi	Medhy, swarya, smrutiprada, rasayani	Kushta, pandu, prameha, raktapitta, kasa, visha, shotha, jwara.	Saraswati, soma, satyavha, Brahmacharini, kapotvega, manuka, Lavanya, somavalli, maha aushadhi, divya.
Rajnighantu Varga – Parpatyadi	Budhi, medha, pradnya, ayushya vardhini	Vata, pitta and rakta vickar hara	Medhya, Surashreshtha, Soumya, bramhakanyaka, surasa, mandukmata, manduki.

MODERN DISEASE REVIEW:

Brahmi became a popular CNS acting drug after research proved its ability to work on psycho somatic diseases. The main role of Bacopa monnieri as an antioxidant appears to be due to its effect on increasing concentration of GSH and enzymatic antioxidants like SOD, CAT, and GPx and as free radical scavenging agent. Hence, its administration in indicated doses may act as a remedy for age-associated memory and cognitive decline in AD. (Chaudhari et al. 2017)

1. REDUCES ANXIETY & STRESS

The leaves of the brahmi plant can be chewed (only 2-3 at a time) in order to relieve stress and anxiety. The active ingredients in this herb can affect hormonal balance in the body and positively impact the balance of stress hormones in our body, thereby inducing a calm, relaxed state in a natural way, avoiding the side effects of traditional pharmaceutical options for stress and anxiety relief. (Pravina et al. 2007) (Menon 2019; Menon Sudeep and Bhlsing V 2022)

2. IMPROVES RESPIRATORY HEALTH

When brahmi is brewed in a tea or chewed as normal leaves, it can boost your respiratory health. It has been used in Ayurvedic treatments for bronchitis, congestion, chest colds, and blocked sinuses. It can clear out excess phlegm and mucus and relieve the inflammation in the throat and respiratory tracts to provide you with rapid relief. (Rastogi et al. 2012)

3. SKIN CARE

If you want to speed up wound healing and disinfect the skin at the same time, spread brahmi juice or oil on the affected area. It can reduce the appearance of scarring and leave you with smooth, healthy skin enriched with its natural essential oils.(Rastogi et al. 2012)

4. ANTI- PARKINSON :

B. monnieri reduces alpha synuclein aggregation, prevents dopaminergic neurodegeneration and restores the lipid content in nematodes, thereby proving its potential as a possible anti-Parkinsonian agent. These findings encourage further investigations on the botanical, and its active constituent compounds, as possible therapeutic intervention against Parkinson's disease. (Jadiya et al. 2011)

5. BRAHMI FOR COGNITION AND MEMORY :

Some of the organic compounds in brahmi stimulate cognitive pathways in the brain to boost cognitive ability. (Singh and Dhawan 1982) A meta-analysis incorporating nine randomized controlled trials (437 subjects) demonstrated an improved speed of attention and cognition and decreased reaction time. (Kongkeaw et al. 2014) In a randomized, double-blinded, placebo-controlled study, patients (54 adults) were given a 300 mg standardized extract of either Bacopa or placebo. The treated group demonstrated enhanced delayed word recall memory scores and increased ability to ignore irrelevant information (Stroop's test) relative to placebo. (Calabrese et al. 2008) Closely related benefit of brahmi is its ability to reduce the onset of cognitive disorders as we age, such as dementia and Alzheimer's disease. Research has shown it to be an effective way of stimulating the creation of new neural pathways and lowering oxidative stress in the brain, which keeps our minds sharp well into our old age. (Russo and Borrelli 2005)

6. ANTI-INFLAMMATORY AND OXIDATIVE STRESS:

B. monnieri can protect the directly affected organ as well as distant organs against I/R injury by modulating anti-inflammatory and anti-nitrosative pathways. (Ozlu et al. 2021) In- vitro study of ethanolic extract of B. monnieri showed Bacopa has significant potential of being antioxidant, anti-sickling and anti-inflammatory and can be used for the treatment of inflammation and sickle cell anaemia. Bacopa can also help to reduce oxidative stress in-vitro conditions. (Pandey 2024) In a randomized control trial of a polyherbal formula containing Bacopa monnieri , the results indicated that cognitive functioning improved in subjects. The memory-enhancing effects were hypothesized to be due to the polyherbal formula's ability to decrease markers of both inflammation (i.e., homocysteine, C-reactive protein, and TNFa) and oxidative stress (i.e., glutathione peroxidase, glutathione, and thiobarbituric acid). (Lewis et al. 2021)

7. Alzheimer's disease:

B. monnieri administration has a protective effect on cholinergic neurons, furthermore, it also decreases the deposition of hippocampal β-amyloids and stress-induced hippocampal damage. Additionally, in humans, *B. monnieri* extracts improve the total memory score with maximum progress in logical memory. Most importantly, *B. monnieri* administration has not revealed any serious side effect. For therapeutic use, *B. monnieri* can be administered as a purified butter-based oral supplement (Brahmi Ghritam) or in powdered form (Churna) or as tablets. (Kiani et al. 2020)

8. Epilepsy:

Ethanol extract (EE), n-Hexane extract (nHE), Ethyl acetate extract (CE) and n-Butanol extract (nBE) extracts of Bacopa monnieri may be beneficial in antiepileptic treatment or the bioactive compounds present in these extracts can be used in the formulation of herbal drugs which can be used in the treatment of epilepsy or to control the seizure generation. Since *Bacopa monnieri e*xhibited anti-seizure activity as evidenced from the present investigation, it might be clinically useful in the control of human epilepsies. (Komali, Venkataramaiah, and Rajendra 2021)

DISCUSSION:

Brahmi is a succulent, non- aromatic herb; usually found in water abundant areas. It is popularly used in Ayurvedic sciences for treatment of psycho-somatic disorders like epilepsy,

stress, anxiety, etc. Its indications for use can be found in popular Ayurvedic literatures like Charak Samhita, Ashtang Hriday and Sushsrut Samhita. In recent times, it has achieved tremendous attention in treating CNS and psychological disorders, The capability of Brahmi to treat disorders like Parkinsons, Alzheimer's, ADHD, Stress, Anxiety, Depression, etc. without producing any side-effects like drowsiness, drug dependency; has made Brahmi a crucial herb in current times. Brahmi has also been proven to be neuroprotective, meaning it can be used as a prophylactic medication for susceptible patients. The ability of Brahmi to not only cure but also help stabilize a patient in distress, makes it a popular Rasayan drug in Ayurveda.

CONCLUSION:

Brahmi (*Bacopa monnieri L*) is a Ayurvedic herb capable of treating neurological and psychological disorders. It is cost effective and safe adjuvant treatment option for these disorders and can be beneficial when used as a prophylactic medication.

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