

Nutraceutical and Ameliorative Activity of *Bacopa Monnieri*(Linn.) Pennell

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Abstract

Bacopa monnieri (Linn.) Penn belong to the family of Plantaginaceae. It is also called Brahmi derived the name of Brahma because it helps to improve the function of mid brain in human due to contains of Saponins components. It acts as memory enhancer, analgesic, antioxidant. There is the presence of improved content of bacoside A3, A and II, Hesperidin, Apobacosides, D-Mannitol, Stigmasterol and Beta-sitosterol. These contents help in efficacy of neuromuscular activity, locomotion and help in Nervine tonic, Sedative, Tranquillizer, Epilepsy, Esthenia, memory enhancer, Antistress. This type of herb is used in various drug formulations in Ayurveda and Unani treatment. It contains many bioactive compounds are present such as tannins, glycosides, and flavanoids and phenolic compounds. In this review, we can also connect to its therapeutic uses that are related to neurological illness.

Keywords: - Bacoside, *Bacopa monnieri*, Nervine, Sedative, Therapeutic

1. Introduction:-

Bacopa monnieri (L.) is commonly known as Brahmi that is a medicinal herb used in Ayurveda. It belongs to the family of Plantaginaceae. It is found in India, Australia and Srilanka. Mainly their leaves are obovate and small white flowers are present. This herb is generally used in enhancing the memory, mental health and promotes the long life (Ghosh S; Kumar, V; 2024, Dash V.B et al., 1980). *Bacopa monnieri* (L.) is generally used in neuropsychological ailments that give the anxiety, and enhance the memory retention capacity. It is also used in anti-inflammatory, antioxidant, glaucoma, cataracts and diabetic retinopathy (Saini et al., 2012). There are many commercial products are there that is used in cereals, fruit beverages, biscuits and in cosmetics industries (Patra et al., 2018). Brahmi is generally used as brain booster that acts as rejuvenator of nervous system (Jain PK, Das D., 2016). It is also called “Wonder Drug”. Because it manage stress induced complications in humans. It contains many Bioactive compounds are present that are used in pharmaceutical industries. It helps in improving the yield of plants such as nitrogen fixation, nutrient absorption as well as synthesis of enzymes and secondary metabolites. The extracts of Brahmi are used in antimicrobial, analgesic and antioxidant, nootropic activity. It is used in neurodegenerative diseases. This review article gives the phytochemical and pharmacological activity that is used in neuroprotection activities.

2. Bioactive Integrant and its rarity

Bacopa Monnieri is rich in secondary metabolites such as saponins, steroids, alkaloids, glycosides, sterol glycosides, sugars, aminoacids, flavanoids and cucurbitacins. *Bacopa monnieri* also contains Hydrocotyline, Nicotine, D-Mannitol, Stigmasterol, Glutamic acid, Alanine, Serine, Herpestine,

Aspartic acid. Bacopa Monnieri contains many compounds that are useful such as Bacoside, Bacopasides, Betulinic acid, Bacosaponins (Bhandari et al., 2020; Ohta et al., 2016). Mainly it is seen that Bacosides-A and Bacopasides have glycosides chains area present that protect the DNA damage and repairing of neurons in purport in Alzheimer's disease. Bacoside A {3-(alpha -L-arabinopyranosyl) 9-Beta-D -glucopyranoside-10, 20- dihydroxy-16-keto-dammar-24-ene}. The identification of various compounds are 3-O-Alpha-L-arabinopyranosyl-20-O-Alpha-L-arabinopyranosyl}-jujubogenin, 3-O-{Alha-L-arabinofuranosyl-(1→3)-α-L-arabinofuranosyl-(1→2)-β-D-glucopiranosyl}pseudojujubogenon. Bacopasides I,II,III,IV and V were isolated and it is isolated 3-O-{α-L-arabinofuranosyl-(1→2)-β-D-glucopyranosyl}jujubogenin, 3-O-β-D-glucopyranosyl-(1→3)-α-L-arabinofuranosyl pseudojujubogenin (Chatterji N, Rastogi RO., 1965; Garay S, Mahato SB., 1996; Chakravarty AK, Sarkar T., 2002).

Bacopa monniera is also contained Betulinic acid, D-mannitol, Stigmasterol, β- sitosterol, Stigmasterol (Avanigadda S et al., 2011).

3. Employ of Bacopa monnieri L.

This plant has bioactive compounds that is included in secondary metabolites such as alkaloids, glycosides, saponins A, B. Bacoside C and A, stigmasterol, beta sitosterol, bacopasides I,II and various types of proteins are used (Mathew et al., 2010).

a) Bacoside A:-

There is triterpenoid saponin is used that is called Bacoside A. Basically it is a fusion of four saponins classes that is Bacoside A3, bacoside II, Bacopasaponin C and jujubogenin. It protects the brain by acting antiapoptotic manner (Deepak et al., 2005; Dar and Channa, 1999).

b) Cucurbitacin:-

When it is fused with betulinic acid it affects the cytotoxic effect against the breast cancer and encourages the G2/ M phase. That help in anti-inflammatory, cytotoxic, antimalarial and help in non cancerous kidney cell lines (Pawar et al., 2007).

c) Bacoside E and Bacopaside VII:-

These are the bioactive compounds present in Brahmi. It is butanolic extraction effective against tumour cell lines that is used in anti inflammatory activity that cause the suppression of prostaglandin synthesis and lysosomal membrane stability (Jain et al., 1994).

d) Bacopaside I,II :-

Bacopaside I is generally used in neurological impairments, edema. It increase the ATP content, antioxidant enzymes, but when these both are combinally used in breast cancer cell lines proliferation, migration and invasion (Palethroe et al., 2019).

4. Salutory sequels

Bacopa monnieri is a traditionally medicine in India. In India it is basically used as Ayurveda for the treatment of Anxiety, Memory boosting, Cardiac problems, respiratory effects, Anti-Asthmatic, Anti allergic, Anti cancer, Anticonvulsive, Anti depressant, Anti inflammatory, Anti nociceptive, Anti oxidant, Anti spasmodic, Anxiolytic, Gastroprotective, Hepatoprotective activities are done (Anon., 2017).

Cucurbitacin plays important role in anticancer drugs due to its derivatives such as Cucurbitacins E, bacitracin A-D. Moreover Bacosine protected against oxidative damage in diabetes and help in

prohibition of glycosylation of haemoglobin. Brahmi is mostly used in various neuro degenerative disorders such as Parkinson's and Alzheimer's disease (Mondal Dr S, Bhar K Mondal P., 2023).

1. Anti inflammatory activity:-

It helps in immunological dysfunction by regulating the cytokines and lowering the level of NF-kB translocation to nucleus. It mainly act on Central Nervous System inflammatory reactions to decrease the level of oxidative stress and formation of ROS and cell enzymes to produce antioxidants that helps to protect infections and tissue injury. I t will increase the level of IL-10 in human blood cells (Velaga MK etal., 2014).

2. Analgesic activity:-

It will increase the activity of aqueous extract of Bacopa monneri that is called AEBM included with naloxone and involvement of opioid receptors in Analgesic activity. In which the involvement of beta 1 anderegenic and alpha 2 adregenic receptors are help to increase the level of analgesic activity (ManjuB etal., 2011).

3. Antioxidant Activity:-

Bacopa monneri L helps to reduce the oxidative stress. The extract of Brahmi is generally used in the upregulation of cytochrome c, Bax and caspase 3 expressions by maintaining the activity of mitochondrial integrity level. It also helps to inhibit the level of superoxide anion formation and reduce the concentration of nitric oxide and activate the level of astrocytes such as epilepsy, ischemia (Colasanti , 2000,Russo A etal.,2003).

4. AntiAsthmatic Activity:-

Bacopa monneri helps to relax the tracheal muscles by beta–adrenoreceptor and prostaglandis that is basically used in various respiratory ailments by reflected the inspiratory and expiratory pressures. Bacopa monneri helps in bronco dilation; it includes adrenoreceptor activation, prostaglandin and help in muscarinic receptor antagonism to exhibit the mast cells (Sharma R etal., 1987).

5. Anti stress Activity:-

Bacopa monneri used in ulcer treatment with their adaptogenic activity with their higher dose activity and their adrenal gland weight to help reduce the stress activity of it.

6. Anti cancer Activity:-

Bacopa monneri L. has many secondary active metabolites that act as anticancer agents in variety of cancer such as breast cancer, colon cancer, liver cancer and prostate cancer.

- a) **Breast cancer:** - It is the most diagonised disease in women that is based on the receptors such as estrogen receptor, progesterone receptor. Estrogen receptor, human epidermal growth factor receptors are responsible in this cancer. Bacopaside I, II these both are used in breast cancer cell lines with their various extracts (Liu etal., 2013).
- b) **Glioblastoma:-** It is one of the primarily brain tumour for the maintenance and self renewal of neural stem cells.The protein/calcium kinaseIIA is phosphorylated by bacoside A in Glistoblastoma multiforme that is called GBM. It helps to speed up the macropinocytosis process in Endoplasmic Reticulum to enlargement of cellular structure and damage of cytoskeletal damage by combination of macropinocytotic vesicles that help to rupture the membrane (Rau fetal. 2013).
- c) **Prostate Cancer:-** The extract of Brahmi has various phenolic bioactive compounds are present that shows the cytotoxicity and anti migration activity in prostate cancer. It is due to the high level of lactate dehydrogenase activity that helps to convert the pyruvate to lactate by reducing the level of LDH. It helps to suppress the activity of cancer growth (Koczurkiewicz etal., 2017).

- d) AntiParkinson's Effect:-** It is a neuro degenerative disorder that is done by loss of neuron that helps to produce Dopamine and alpha-synuclein protein that is accumulated in lewy bodies. This herb attenuates the behavioural deformity by reducing the oxidative stress and neuronal cell death in brain and restored the cell growth (Jadiya et al., 2011).
- e) Alzheimer's Disease:-** Brahmi is used to increase the level of glutamate level with increase the platelet activating factor by maintaining the level of mitochondrial enzymes that help to deviate the level of morphine induction (Sumathi et al., 2011).
- f) Antidepressant Activity:-** Brahmi is generally used in morphine induction drug that is useful to adjunct to cure the depression with neurotrophic factor that is called BDNF (Banerjee et al., 2014).

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