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# REVIEW ON POTENTIAL PLANT BASED DRUGS FOR MEMORY ENHANCER

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## ABSTRACT

Many herbal plants are used now a day for various purposes. There extensive used is mainly due to their less toxic effect in comparison of other synthetic drugs, there are a number of preparation are present in the market like creams, tonics, tablets, capsules etc. One of the great achievements of herbal drugs is to improve the learning and memory. Memory is the ability of a human individual to record the information and recall it at later when needed. Several diseases such as dementia, Alzheimer's disease in which memory progressively decreases over period of time. The herbal drugs or their extracts are used to improve the memory by different ways. They decrease the activity of AchE enzyme and hence increase in cholinergic activity which causes the improvement in learning and memory. Many herbal drugs act as antioxidant and prevent the ageing due to which memory improves. Restoration of insulin receptor by herbal drug also improves the memory. The improvement in learning and memory of experimental animals can be determined by the elevated plus maze test, passive avoidance test and different biochemical estimation. After administration of these drugs show positive result in above mention test.

**KEY WORDS:** Herbal Drugs, Memory Enhancer, Alzheimer's disease, Passive Avoidance.

## INTRODUCTION

Herbal drugs are used since traditional system of medicine. There broad spectrum of action affects the human body by different ways. There action on brain is the main concern as they affect brain in different ways [1]. Many herbal drugs have ability to pass the blood brain barrier (BBB) and show their action in the brain. Many herbal drugs have ability to enhance the memory in normal as well as in neurodegenerative brain. Their actions involved the interaction of neurohumoral signaling and responses and the cholinergic system [2]. Memory is the ability of an individual to record the sensory stimuli, events, information etc. and retain it for short and long period of time and recall it at later date when needed. The loss of intellectual ability causes the impairment in the memory and causes the dementia. The main cause of dementia is the Alzheimer's disease. In Alzheimer's disease there is the loss of neurons in distinct brain areas and cord. Age, stress, and emotion may lead to memory loss, amnesia, anxiety, high blood pressure, dementia, schizophrenia, Alzheimer's disease. Many memory enhancer and cognitive enhancer improve the mental function such as cognition, memory, intelligence, motivation, attention and concentration [3]. Many herbal drugs that acts on brain and improves the memory and act as memory enhancer.

### Amla (Amwala churna)

Amwala churna is used in traditional medicine for the treatment of diarrhea, jaundice, headache, dizziness, and inflammation. It belongs to family Euphorbiaceae and found all over India, Sri Lanka, Malaysia, China, Russia and Bangladesh. It is used as potent antimicrobial, adaptogenic, antitumor, antioxidant, and antiulcerogenic agent. Its antioxidant activity is useful in the age related disorders such as cancer, hypertension, atherogenesis, Alzheimer's disease, and Parkinson's disease. Antioxidant activity of *Amwala churna* is mainly due to vitamin C which is the richest source in it. Other antioxidant like, active tannoid principal (Emblicannin A, Emblicannin B, Punigluconin and Pedunculagin) have been identified. Tannins, flavonoids, alkaloids and lignans are also present in *Amwala churna*[4]. Alzheimer's disease is may caused due to high cholestrol level in the CNS. There is the deposition of β-amyloid (an extracellular protein) plaques in the blood vessels and intraneuronal neurofabrillary tangles. High cholestrol level increases β-amyloid in the vessels causes Alzeimer's disease. CNS cholestrol level changes with change in the peripheral cholestrol level. Administration of *Amwala churna* reduces the level of cholestrol and decreases the deposition of β-amyloid in vessels and increase the memory and prevent the Alzheimer's disease. Impairment in the cholenergic function causes selective loss of cholenergic neurons

and decrease in cholinacetyl-transferase activity shows cognitive dysfunction and causes dementia. Ascorbic acid and tannoid are the main constituent present in the *Amwala churna* which has antioxidant activity. They reduces the level of oxygen-free radicals and other by products of oxidative metabolism which causes neurotoxicity and improves cerebellar physiology and motor learning in aged rats and reduces the Alzheimer's disease[5].

**Turmeric (Curcuma longa)**

Curcumin is the main active constituent present in the rhizomes of *Curcuma longa* and belongs to the curcuminoid class. The other two curcuminoids are polyphenol which are responsible for the yellow color of *Curcuma longa.* Beside curcumin various volatile oils including turmeron, atlantone, and zingiberone are also present in the *Curcuma longa.* It is used as antioxidant, anti-inflammatory, hepato-protective, anticancer and antimicrobial agent. It acts on brain, cardiovascular and gastrointestinal system and also enhances the immunity [6]. Degeneration of neurons causes the Alzheimer's disease which is mainly due to the oxidative damage to neurons and prevention of this degeneration is a useful prevention for Alzheimer's disease. Streptozotocin are used to decrease the metabolism of glucose and glycogen in the cerebral cortex and hippocampus which causes the reduction in brain oxidative metabolism and altered the learning and memory and cerebral energy balance. Streptozotocin treated rat shows decrease in the spatial learning and memory and also decrease the insulin receptors - (IR) level in the hippocampus and cerebral cortex. Pre- and post-treatment of curcumin restored the insulin receptors in brain and hence increases the learning and memory which is reduced by streptozotocin. Increase in the activity of AchE enzyme decreases the cholinergic activity and progressively causes the dementia. Streptozotocin induced rat shows increase in the activity of AchE which is treated by pre- and post-treatment of curcumin which increases the cholinergic activity. Free radical scavenging activity of curcumin decreases the oxidative stress which is produced by streptozotocin in rats and increases the learning and memory [7].

**Ashwagandha (Withania somnifera)**

Withanoloids isolated from the *Withania somnifera* inhibits acetylcholinesterase and butylcholinesterase and hence Withania somnifera used in the treatment of Alzheimer's disease. Isolated sitoindosides VII-X and withaferin-A used in Indian medicine to attenuate cerebral functional deficits, including amnesia, in geriatic patient [8]. When *Withania somnifera* treated for 2 weeks, it significantly reversed bith ibotenic acid induced cognitive

deficits and the reduction in cholenergic markers. Treatment with withanoloids A induced significant regeneration of both axons and dendrites, in addition to the reconstruction of pre- and postsynapses in the neurons in memory deficits mice. Oral administration of withanoside significantly improves memory deficits in β-amyloid injected mice and prevent the loss of axons, dendrites and synapses in the cerebral cortex and hippocampus. In behavioural experiment, *Withania somnifera* improves the retention of a passive avoidance task in a step down paradigm in mice and it reverse the action of scopolamine and showing memory enhancing property. *Withania somnifera* has antioxidant property by which it inhibit the free radical mediated oxidative damage and reverse the effect of streptozotocin in diabetics. *Withania somnifera* is without having any serious toxicity or side effects known till date and thus can be used safely in humans for acute and chronic treatment of regimen [9].

**Brahmi (Bacopa monniera)**

*Bacopa monnieri* is used as nerve tonic in traditional ayurvedic medicine system. It is also used as anti-inflammatory, antioxidant, antimicrobial, and antidepressant agent. The active constituents of *Bacopa monnieri* is the mixture of Saponins (bacoside A, bacopasides I and II, and bacopasaponin C). Mechanism of neuroprotecting action of *Bacopa monnieri* is still unknown, but some study reported that it reduced the Beta-amyloid levels in the brain of an Alzheimer's disease transgenic mouse model. Other mode of action was thought to be involved with *Bacopa monnieri's* antioxidant properties including metal ions reduction, free radical scavenging and lipid peroxidation inhibitory activities as well as enhancement of antioxidant enzymes [10]. A memory enhancing effect of *Bacopa monnieri* was established in animal experiment as well as in healthy volunteers. Low dose of *Bacopa monnieri* for two week did not shows ant significant improvement in spatial learning compared to normal control rats. But higher dose of *Bacopa monniera* (40 and 80 mg/kg) show higher number of alternation and lesser percentage bias in comparison with normal control in spontaneous alternation test. In rewarded alternation test, higher dose of *Bacopa monniera* increases percentage of correct response. But when we administered the *Bacopa monniera* for longer duration in spontaneous and rewarded alternation test shows higher number of alternation, lesser percentage bias and increases the percentage of correct response at all doses groups in comparison with normal control rats. According to passive avoidance test, there no behaviour changes duration exploration. Rats spend less time in the small compartment when treated with higher dose (40 and 80 mg/kg) after 2$^{nd}$ week. Low dose does not show significant results. But treatment with all doses (20, 40 and 80 mg/kg) for longer period of time (4 or 6

weeks) shows less time spend by rats during retention test. Therefore, all finding shows oral administration of *Bacopa monniera* extract for longer period improved learning and memory in rats. Different chemical constituent are isolated from *Bacopa monniera* but only steroidal saponin and basocides A and B are responsible for the memory facilitating action [11].

**Liquorice (Glycyrrhiza glabra)**

*Glycyrrhiza glabra* is a perennial legume shrub plant, and found in China, Spain, Israel, Syria, Turkey, Italy, Iran and Russia. The principle constituent of *Glycyrrhiza glabra* by which it woes it characteristic sweet taste is glycyrrhizin. Other constituents present in *Glycyrrhiza glabra* are glucose, sucrose, mannite, starch, asparagines, bitter principals, resins, a volatile oil and coloring matter which collectively give *Glycyrrhiza glabra* its pharmacological properties. It acts as antiulcer, lowers cholesterol, increases immunity, and anti-allergic agent[12]. *Glycyrrhiza glabra* extract has the property to enhance the learning behaviour and memory. In elevated maze test, there is no significant change in the transfer latency when *Glycyrrhiza glabra* extract is administered at a dose of 75 mg/kg in mice. But when we increase the dose of extract to 175 mg/kg, it decreases the transfer latency and significant improvement in the learning behaviour and memory. Further increase in the dose of extract increases transfer latency and impair the learning due to the lethal effect at high dose. Pre-treatment with 150 mg/kg *Glycyrrhiza glabra* extract for 7 days protect the mice from learning and memory impairment produced by interoceptive stimuli i.e. scopolamine and diazepam. *Glycyrrhiza glabra* also increases step down latency which indicates the memory improvement in mice. These finding suggest the neuroprotective effect of *Glycyrrhiza glabra*. *Glycyrrhiza glabra* also exhibit anti-inflammatory action and hence useful in the treatment of Alzheimer's disease in which chronic inflammation of certain region of brain exist. *Glycyrrhiza glabra* also possess antioxidant property by virtue of which susceptible brain cells get exposed to less oxidative stress and reduce brain damage and improve neuronal function and then enhancing the memory [13].

**Anacyclus pyrethrum**

*Anacyclus pyrethrum* is a perennial, procumbent herb and found all over India. It is used as nerve tonic in traditional system of medicine. It has also anti-inflammatory, immune-stimulating, and anabolic, aphrodisiac activities. Main constituent are anacyclin, pellitorine, hydrocarolin, inulin, traces of volatile of volatile oils and seasam in present in the roots of *Anacyclus pyrethrum* [14]. Its mechanism of action is unknown but some concern is due to its

AchE inhibitory action. In the present study suggest that ethanolic extract of *Anacyclus pyrethrum* has memory activity in Scopolamine induced amnesia in rats by elevated plus maze test. *Anacyclus pyrethrum* extract treated wistar rat shows decrease in the transfer latency values with increase in dose of extract. In passive avoidance paradigm, there is also increase in the step down latency (SDL) showed by *Anacyclus pyrethrum* treated rats as compared to Scopolamine which decreases the step down latency. *Anacyclus pyrethrum* also facilitates the social learning task. *Anacyclus pyrethrum* has also effect on cholinergic system and facilitation of central cholinergic activity improves memory. *Anacyclus pyrethrum* inhibits the action of enzyme acetylcholinestrease due to which the concentration of acetylcholine increases in brain homogenate and hence improves memory in rat. The above finding suggested that *Anacyclus pyrethrum* decreases the effect of Scopolamine and act as neuroprotective agent in the Scopolamine induced amnesia in rats [15].

**Centenella asiatica**

*Centella asiatica* is the herbaceous creeper belongs to the Apiaceae family and grown in tropical and sub-tropical countries. It is abundantly found in Madagascar and used both by traditional and modern system of medicine. Plant contains a variety of pentacyclic triterpenoids. Asiaticosides and Madecassosides are the two most important active compound used in the preparation of medicine[16]. It promotes intelligence and decreases irritation and agitation. Radial arm maze test is used to test the spatial memory in three month old mice. Memory enhancement can be dertermined by increase in the number of correct enteries. At a dose of 200 mg/kg, there is significant decrease in time taken to complete the test. But when dose increases, there is increase in the numberof correct enteries and the time taken to complete the test is also increases in dose dependent manners. This increase in the completion of the test is dueto depressant activity at higher dose of the extract. Therefore, 200 mg/kg dose is effective in enhancing the spatial memory. Sixth month administration of *Centella asiatica* increase the levels of AchE and dentritic arborization of CA3 pyramidal neurons. Increase in the dentritic arborization and synapses in CA3 pyramidal neurons of the hippocampus which result in the fascilitation of acquisition and performance in spatial learning tasking. The increase in the dentritic arborization increases the number of possible synaptic connections with the neuron and thus may improves the learning and memory observed in the treated mice. Increase in the level of AchE might reflect the enhancement of AchE release which could fascilitate the synaptic transmission of CA3 pyramidal neurons. And hence AchE activity in hippocampus is measured as a marker enzyme for cholinergic

function. Extract of *Centella asiatica* has also been reported to increase the endogenous antioxidant enzymes in the rat brain [17].

## CONCLUSION

From this study, it is found that above mention herbal drugs have ability to improve the learning and memory in experimental animals as well as in the human being.

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