IAMJ

Review Article *International Ayurvedic Medical Journal* *ISSN:2320 5091*

ROLE OF *AYURVEDIC* HERBS IN CHILD PSYCHIC HEALTHCARE – A REVIEW

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ABSTRACT

Mental disorders are characterized by a clinically significant impairment in social, academic or occupational functioning. Because of its enormous social and public health importance, mental health is one of the six National Health Priority Areas. Families in which there are children with mental health problems face many difficulties, with parents likely to worry more about their children's health, reporting having less time for their own needs, experiencing more stress and being less able to cope than other parents. According to World Health Report (2000), 20% of children and adolescents suffer from a disabling mental illness worldwide. Indian studies revealed the prevalence rates to be 12.5% in 0-16 yrs community based sample from Bangalore. As per *Ayurveda* main causative factors for the Psycho or Somatic or Psychosomatic diseases are: vitiation (*Vibhransh*) of rational thinking: (*dhee),* intellect / retaining power of the mind (*dhriti*), memory (*smriti*),; Abnormality or variations of seasons and abnormal conduct (*Ayoga* of *kala, karma)* ; Improper contact of the senses with their objectives (*Asatmendriyartha samyoga*). In modern science wisdom treatment of these disorders include anti anxiety, anti psychotic, anti depressant, mood stabilizing and stimulant drugs which are first line of therapy in such disorders but here is an problem due to its untoward effects like nausea, vomiting, abdominal cramps, loss of appetite, dizziness, irritability and tics etc while *Medhya* (Memory Booster and enhancer) drugs referred in *Ayurveda* for such psychiatric disorders are very effective and safe. *Charaka* has been classified *Medhya Dravya* which act upon the brain sector and enhance the memory. Author made an attempt with detailed and in-depth literary study to explore the scope and efficacy of the *Ayurveda* drugs in the child mental health care. Study area was limited from 1990 to till date for finding the evidence based documents on the *Ayurveda* drug's efficacy.

Keywords: *Dhee, Dhriti, Smriti*, *Atatvabhinivesh*, *Medhya*

INTRODUCTION

Mental health problems experienced by children may be manifested early on as disturbances of feelings, behaviors and thoughts. If these disturbances are distressing to the child or the parents, and if social and other functioning of the child is affected, then a mental health problem may be identified.[1] Mental disorders are characterized by a clinically significant impairment in social, academic or occupational functioning.[2] Because of its enormous social and public health importance, mental health is one of the six National Health Priority

Areas.[3] Families in which there are children with mental health problems face many difficulties, with parents likely to worry more about their children's health, reporting having less time for their own needs, experiencing more stress and being less able to cope than other parents.[4]

Prevalence of mental disorders among children has been reported to be 14-20% in various studies.[5] According to World Health Report (2000), 20% of children and adolescents suffer from a disabling mental illness worldwide.[6] Indian studies revealed the prevalence rates to be 12.5% in 0-16 yrs community based sample from Bangalore.[7] While genetic factors have been implicated in some types of mental illnesses, such as schizophrenia, bipolar disorder and depression, mental health problems and disorders can be due to an interaction between biological factors and adverse psychosocial experiences (USDHHS 2000).[8] It has been suggested that some children may have a genetic vulnerability to certain disorders, but that these disorders will not develop without the interaction of the genes with non-genetic risk factors. A number of risk factors have been associated with a higher likelihood of developing a mental disorder, but this does not mean that these factors cause mental illness, or that everyone who is exposed to them will develop a mental disorder. In many cases different risk factors may be closely associated with one another. Most commonly occurring mental health disorders in children is divided into two areas as *general* and *specific*. Internalizing and externalizing problem are included in to the general area while specific areas include somatic complaints, delinquent behavior, attention problems: difficulty concentrating and sitting still, and impaired school performance, aggressive behavior, social problems such as impaired peer relationships, withdrawal problems like shyness and social isolation, anxious/depressed and thought problems.[9]

Moreover, *Ayurveda* emphasizes that the *Dhhe*, *Dhrti* and *Smriti* are three components of intellect or wisdom. As per *Ayurveda* main causative factors for the Psycho or Somatic or Psychosomatic diseases are: vitiation (*Vibhransh*) of rational thinking: (*dhee),* intellect / retaining power of the mind (*dhrti*)*,* memory (*smriti*)*,*; Abnormality or variations of seasons and abnormal conduct (*Ayoga* of *kala, karma)* ; Improper contact of the senses with their objectives (*Asatmendriyartha samyoga*).[10]

Treatment of these mental disorders include anti anxiety, anti psychotic, anti depressant, mood stabilizing and stimulant drugs which are first line of therapy in such disorders but here is an problem due to its untoward effects like nausea, vomiting, abdominal cramps, loss of appetite, dizziness, irritability and tics etc. *Medhya* drugs described in *Ayurveda* are advocated in these psychiatric disorders which are very effective and safe. *Charaka* classified such drugs with the name of *Medhya Dravya*, which act upon the brain sector and enhance the memory. *Mandukparni* (*Centella asciatica*), *Madhuyashti* (*Glycerriza glabra*), *Guduchi* (*Tinospora cordifolia*) and *Shankhpushpi* (*Convovulusare plauricaulis*) are said to be the best *Medhya* drugs.[11] An effort is made in this paper to explore evidence based *Ayurvedic* herbs which play vital role in revitalization of mental health disorders in children.

Review of Studies:

1. **Cognitive Activity**

In a double-blind study placebo-controlled independent-group design in which subjects were randomly allocated to one of two treatment conditions, bacopa (300 mg) or placebo. Neuropsychological testing was conducted pre (baseline) and at 5 and 12 weeks after drug administration. *Bacopa monniera* (*Brahmi*) significantly improved speed of visual information processing measured by the IT task, learning rate and memory consolidation measured by the AVLT (Auditory Verbal Learning Test) and state anxiety compared to placebo, with maximal effects evident after 12 weeks. These findings suggest that *Bacopa monniera* may improve higher order cognitive processes that are critically dependent on the input of information from our environment such as learning and memory.[12]

In a double-blind, placebo-controlled trial of 38 healthy volunteers of ages 18-60 were given a single dose of 300 mg *Bacopa monniera* extract (standardized to 55-percent combined bacosides A and B) or placebo. After two hours of drug administration no significant changes in cognitive function on acute administration of bacopa extract to baseline values.[13]

On giving alcoholic extract of withania to rats it decreased locomotors activity, learning behavior, potentiated barbiturate hypnosis while increased serotonin and histamine levels in brain tissue along with catecholamine's depletion. Thus it induced increase in cortical muscaranic ACH receptor capacity and this might partly explain the cognition enhancing effects of Withania.[14]

To investigate the effects of *Madhuyashti* (*Glycyrrhiza glabra*) (popularly known as liquorice) on learning and memory in mice, three doses (75, 150 and 300 mg/kg p.o.) of aqueous extract of *Glycyrrhiza glabra* were administered for 7 successive days in separate groups of animals. The dose of 150 mg/kg of the aqueous extract of liquorice significantly improved learning and memory of mice. Furthermore, this dose significantly reversed the amnesia induced by diazepam (1 mg/kg i.p.) and scopolamine (0.4 mg/kg i.p.).[15]

2. **Effect on Memory**

W. somnifera's methanolic extract (50% menthol) and aqueous extract with honey and ghee was administered in a dose of 250 mg/kg in both control and stressed young and old rats. Both the extracts failed to reverse the stress-induced anxiety but traditional extract was found to be more active in memory enhancement than anxiolytic and antidepressant activity.[16]

In a study *Brahmi Rasayana* (BR) was administered in a dose of 100 and 200 mg/kg p.o for eight days to both young and aged mice. Elevated plus maze and passive-avoidance paradigm were employed to evaluate learning and memory parameters. Scopolamine (0.4 mg / kg i.p.) was used to induce amnesia in mice. BR significantly improved learning and memory in young mice and reversed the amnesia induced by both scopolamine (0.4 mg kg^{-1} i.p.) and natural aging. BR significantly decreased whole brain acetyl cholinesterase activity that proves it to be a useful memory restorative agent in the treatment of dementia.[17]

Research using a rat model of clinical anxiety demonstrated Bacopa extract of 25% bacoside A exerted anxiolytic activity

comparable to Lorazepam a common benzodiazepine anxiolytic drug. Bacopa extract did not induce amnesia which was side effects with Lorazepam but instead had a memory-enhancing effect.[18]

In a study, Withanoside IV (a constituent of WS; the root of WS) induced neurite outgrowth in cultured rat cortical neurons. Oral administration of withanoside IV significantly improved memory deficits in A beta-injected mice and prevented loss of axons, dendrites, and synapses. Sominone, an aglycone of withanoside IV, was identified as the main metabolite after oral administration of withanoside IV. Sominone induced axonal and dendritic regeneration and synaptic reconstruction significantly in cultured rat cortical neurons damaged by Abeta. Withanoside IV may ameliorate neuronal dysfunction in Alzheimer's disease and that the active principle after metabolism is sominone.[19]

To assess the potential of *N. jatamansi* as a memory enhancer, the elevated plus maze and the passive avoidance paradigm were employed to evaluate learning and memory parameters. Three doses (50, 100, and 200 mg/kg, p.o.) of an ethanolic extract of *N. jatamansi* were administered for 8 successive days to both young and aged mice. The 200 mg/kg dose of *N. jatamansi* ethanolic extract significantly improved learning and memory in young mice and also reversed the amnesia induced by diazepam (1 mg/kg, i.p.) and scopolamine (0.4 mg/kg, i.p.).[20]

On oral administration of *Anwala churna* (*Emblica officinalis* Gaertn.) in three doses (50, 100 and 200 mg/kg) for fifteen days to different groups of young and aged mice to evaluate effect on memory, total serum cholesterol levels and brain cholinesterase activity. Elevated plus maze and passive avoidance apparatus served as the exteroceptive behavioral models for testing memory. Diazepam, scopolamine and ageing-induced amnesia served as the interoceptive behavioral models. Total serum cholesterol levels and brain cholinesterase activity also estimated. *Anwala churna* (50, 100 and 200 mg/kg, p.o.) produced a dose-dependent improvement in memory scores of young and aged mice. Furthermore, it reversed the amnesia induced by scopolamine (0.4 mg/kg, i.p.) and diazepam (1 mg/kg, i.p.).[21]

3. **Nootropic activity**

In a study *Ashwagandha* (*Withania somnifera* L.) root extract (50, 100 and 200 mg/kg; orally) were found to improve retention of a passive avoidance task in a step-down paradigm in mice. Daily administration of *Ashwagandha* for 6 days significantly improved memory consolidation in mice receiving chronic electroconvulsive shock (ECS). *Ashwagandha*, administered on day 7 attenuated the disruption of memory consolidation produced by chronic treatment with ECS. On the elevated plus-maze *Ashwagandha* reversed the scopolamine (0.3 mg/kg)-induced delay in transfer latency on day 1. On this basis it is suggested that *Ashwagandha* exhibits a nootropic-like effect in naive and amnesic mice.[22]

The alcoholic extract of *Bacopa monniera* facilitated the acquisition, consolidation and retention of memory as seen by its effect on 3 newly acquired behavioral responses in albino rats, viz. foot shock motivated brightness discrimination and active

conditioned avoidance and Sidman continuous avoidance responses.[23]

The acetone soluble fraction of petroleum ether extract of *Lawsonia inermis* (*Mehendi*) leaves showed significant nootropic effect on the elevated plus maze and passive shock avoidance paradigms. The extract also potentiated clonidine induced hypothermia and decreased lithium induced head twitches. This indicates that it affects 5HT and noradrenalin mediated behaviour.[24]

Various extracts derived from the seeds of *Pongamia pinnata* (*Karanja*) decreased pentobarbitone sleeping time, probably by stimulation of the hepatic microsomal enzyme system. Similar properties were exhibited by its roots. [25]

4. **Anticonvulsant activity**

Anticonvulsant activity was seen on administering intraperitoneal injections of high doses of Bacopa extract (close to 50 percent of LD50) to mice for 15 days while lower dose were found ineffective. (25 percent of LD50).[26] Hersaponin- active constituents of bacopa exhibited protection against seizures in mice. But it did not protect rats against electro shock.[27]

In another study Powder, Decoction and alcoholic extract of *Withania Somnifera* were anticonvulsant vs Electroshock and Pentobarbitone. Alcoholic extract was more potent.[28]

In a study carried out by Manocha, et al, Ginkgo biloba decreased the protective effect of sodium valporate and carbamazepine against picrotoxin as well as strychnine induced convulsions in mice.

5. **Anti anxiety (psychoactive) and antidepressant**

A one-month, limited clinical trial of 35 patients with diagnosed anxiety neurosis demonstrated that administration of *Brahmi* syrup (30 mL daily in two divided doses, equivalent to 12 g dry crude extract of Bacopa) resulted in a significant decrease in anxiety symptoms, level of anxiety, level of disability, and mental fatigue, and an increase in immediate memory span. Other changes noted were increased body weight, decreased respiration rate, and decreased systolic blood pressure.[29]

Glycowithanolides (WSG) isolated from dry root of *Ashwagandha* (*W. somnifera*) was given 20 and 50 mg/kg OD orally for 5 days in rats. The results were compared by those elicited by the benzodiazepines Lorazepam (0.5 mg/kg) for antidepressant investigations and mood changes. The investigations support the use of WS as a mood stabilizer in clinical conditions of anxiety and depression.[30]

In a study, compound preparation consisting of *Mandukparni* (*Centella asiatica*), *Yashti* (*Glycyrrhiza glabra*) and *Jatamansi* (*Nordostachys jatamansi*) in the ratio of 1:2:2 suspended in *Ksheerbala Thailam* was assessed for its anxiolytic property. 12 patients of both sexes in the age range of 20-25 yrs were treated for 45 days. The drug was effective in enhancing the perceptual discrimination and psychomotor performance. It was also effective in controlling the somatic and psychic anxiety.[31]

The ethanol extract from the fruit of *Pippali* (*Piper longum*) yielded piperine showed an inhibitory effect against monoamine oxidase-A and MAO-B. The inhibition by piperine was found to be reversible by dialysis of the incubation mixture. In addition the immobility times in tail suspension test were significantly reduced by piperine, similar to that of the reference an-

tidepressant fluoxetine, without accompanying changes in ambulating when assessed in an open field. These results suggest that piperine possesses patent anti depressant like properties.[32]

In a double blind study forty healthy volunteers received either 100 mg of valerian extract, 209 mg of propanolol, or a combination of both. In contrast to propanolol, valerian was not associated with reduction in physiological arousal under stress but it did show improvement in anxiety and mood.[33]

The leaf extract of *Azadirachta indica* (*Neem*) exhibited anxiolytic effects comparable to diazepam at low doses (10-200 mg/kg) when tested in rats. Higher doses (>400 mg/kg) however, did not show anxiolytic activity.[34]

Methanolic extract of rhizomes of *Nelumbo nucifera* (*Kamal*) was found to cause significant reduction in spontaneous activity, decrease in the exploratory behavioural pattern by the head dip and Y maze tests muscle relaxant activity and potentiation of pentobarbitone induced sleeping time.[35]

Ginkgolic acid conjugates (GAC) (6-alkylsalicylates, namely n-tridecyl-, n-pentadecyl-, n-heptadecyl-, npentadecenyl- and n-heptadecenylsalicylates) isolated from the leaves of Indian *Ginkgo biloba* Linn. PAF antagonist, showed consistent and significant anxiolytic activity.[36]

6. **Adaptogenic activity**

In a study, the adaptogenic property of a standardized extract of *Bacopa monniera* against acute (AS) and chronic stress (CS) models in rats had been seen.[37]

The antistress effect of bacosides of *Brahmi* (*Bacopa monnieri*, BBM), dissolved in distilled water, was studied in adult male Sprague Dawley rats by administering oral doses of 20 and 40 mg/kg for 7 consecutive days. The data indicate that BBM has potential to modulate the activities of Hsp70, P450 and SOD thereby possibly allowing the brain to be prepared to act under adverse conditions such as stress.[38]

In a series of experiments the whole, aqueous standardized extracts of *Guduchi* (*Tinospora cordifolia*), *Shatavari* (*Asparagus racemosus*), *Amalaki* (*Emblica officinalis*), *Ashwagandha* (*Withania somnifera*), *Pippali* (*Piper longum*) and *Haritaki* (*Terminalia chebula*), were administered orally to experimental animals, in a dose extrapolated from the human dose. These animals were exposed to a variety of biological, physical and chemical stressors. The plants were found to offer protection against this stressors.[39]

Ethanol extract of *Tulsi* (*Ocimum sanctum)* powder were administered to rats (100 ml/kg) and other animals (100 mg/kg) orally for 7 days. On the 8th day rats were exposed to 30 min noise stress and ½ hr later were sacrificed. The ethanolic extract of *Ocimum sanctum* reversed the changes in plasma levels of corticosterone induced by exposure to both acute and chronic noise stress, indicating the antistress property of the plant against noise.[40]

7. **Neuroprotective activity**

Study was conducted in middle cerebral artery occlusion model of acute cerebral ischemia in rats. All the alternations induced by ischemia were significantly attenuated by 15 days pretreatment of *N. jatamansi* (250 mg/kg, orally) and correlated well with histopathology by decreasing neuronal cell death following occlusion and reperfusion.[41]

Mandukparni (*Centella asciatica*) significantly attenuated decreases in the levels of glutathione, glutathione peroxidase and significant neuroprotective effects on cultured cortical cells by their potentiating of cellular oxidative defense mechanism.[42]

8. **Effect on learning aid**

In a study treatment with alcoholic extract of *Brahmi* (*Baccopa monnieri*) improved maze learning (learning performance) in rats and the activity is due to saponins bacosides A and B and other saponins. (Aslokar 2000) In another study oral treatment of rats with the extract of *B. monnieri* for 24 days facilitated their ability to learn mazes.[43]

Three doses (50,100 and 200 mg/kg) of an ethanolic extract of the *Jatamansi (Nordostachys jatamansi*) were given for 8 successive days to both young and aged mice, 200 mg/kg dose significantly improve the learning and memory in young mice because of facilitation of cholinergic transmission in the brain.[44]

Oral administration of fresh plant extract of *Mandukparni* (*Centella asciatica*) to rat pups with a dose of 2 ml/kg/day for 6 wks was subjected to learning tests in T-maze and passive avoidance test. The result indicates a correlation between improved learning capacity and increased dendritic arborization in amygdaloid nucleus. This may be the neural basis for enhanced learning in *C. asciatica* treated rats.[45]

Thirty healthy volunteers of age 18-30 years received *Guduchi* (*Tinospora cordifolia*) (500 mg of pure aqueous extract) or a matching placebo for 21 days in a double blind, randomized and placebo controlled design. Learning and memory was assessed by subjecting the volunteers to a battery of psychological tests. *Tinospora cordifolia* showed a significant ($p < 0.05$) increase in the test scores for 'verbal learning and memory' 'logical memory'.[46]

In a double blind study eighty healthy subjects were treated with valerian syrup, tablets containing valerian and hops, flunitrazepam or a placebo. Assessment included self-rating scale of well being, objective of cognitive and psychomotor performance, as well as evaluation of the tolerance. On the morning following treatment impaired performance was observed in flunitrazepam group only on both subjective and objective ratings where as those receiving valerian formulation noted feeling better, more alert and active.[47]

9. **Effect on behavior**

In an experimental study rats were divided in to three groups given either nothing, diazepam (Valium) or Bacopa were trained in a simple T-maze. At the end of 10 day trial, evaluated by repeating T-maze trial which indicate that Bacopa showed remarkable learning and memory enhancement and an increase in serotonin level.[48]

10. **Effect on ADHD (Attention deficit hyperactivity disorder)**

36 ADHD (Attention deficit hyperactivity disorder) children were selected to conduct double-blind randomized placebo controlled study. 19 children were treated with Bacopa extract 50 mg twice daily for 12 weeks while 17 subjects were treated with placebo. The mean age of the children in the two groups was 8.3 years and 9.3 years, respectively. After 12 week significant effects were observed in Bacopa-treated subjects evidenced by improvement on sentence repetition, logical memory and paired associate learning tasks.[49]

DISCUSSION

Experimental and clinical studies of various *Ayurvedic* drugs discussed here possess cognitive, memory enhancing, nootropic, anti-anxiety, antidepressant, anticonvulsant, neuro-protective and adaptogenic activity. These drugs also play role in learning aid, behaviour, intellectual function and ADHD.

Withania somnifera (*Ashwagandha*) increase brain serotonin and histamine level which enhance cortical muscarnic ACH receptor capacity lead to improve cognition while *Brahmi* (*Bacopa monniera*) correct speed of visual information. On the other hand *Madhuyashsti* (*Glycerrhiza glabra*) reverse induced amnesia.

Ashwagandha (*Withania somnifera*), *Brahmi* (*Bacopa monniera*), *Karanja* (*Pongamia pinnata*) and *Mehandi* (*Lawsonia inermis*) show nootropic effect. *Amalaki* (*Emblica officinalis*) and *Jatamansi* (*N. Jatamansi*) in higher dose act as memory booster along with reverse effect on benzodiazepine amnesia.

Withania somnifera is a proven anticonvulsant drug which posse protection against electroshock while *Bacopa monniera* is required in higher dose to produce desired anticonvulsant action. *Ginkgo biloba* a drug that ameliorate effect of other anticonvulsant drug in strychnine induced convulsion.

The drugs *Brahmi* (*Bacopa monniera*), *Ashwagandha* (*Withania somnifera*), *Jatamansi* (*N. jatamansi*), *Pippali* (*Piper longum*), *Tagar* (*V.wallchi*), *Neem* (*Azadirachta indica*) and *Kamala* (*Nelumbo nucifera*) possess psychoactive as well as antidepressant activity. *N. jatamansi* can cause overall increase in the levels of central monoamines and inhibitory amino acids and therefore can be used as an antidepressant agent. *P. longum* also can be used as a promising antidepressant agent as it acts through the inhibition of MAO activity.

Shatavari (*Asparagus racemosus*), *Amalaki* (*Emblica officinalis*), *Ashwagandha* (*Withania somnifera*), *Pippali* (*Piper longum*) and *Haritaki* (*Terminalia chebula*) has potential to reverse biological, physical and chemical stress that's why posses strong adaptogenic activity while *Tulsi* (*Ocimum sanctum*) shows anti stress activity due to reversal of increased plasma corticosteroid level. *Mandukparni* (*Centella asciatica*) and *Jatamansi* (*N. jatamansi*) shows neuroprotective activity by virtue of antioxidant property.

CONCLUSION

Overall reviews of experimental and clinical studies of *Medhya* drugs mentioned in *Ayurvedic Samhita* authenticate their action on brain. Therefore, these drugs helpful to correct vitiation (*Vibhransh*) of rational thinking: (*dhee),* intellect / retaining power of the mind (*dhriti*), memory (*smriti*). Thus these review clearly provide a guideline in the management of psychiatric disorder and helpful in complete restoration of mental status of children.

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Source of support: Nil
Conflict of interest: None Declared