



## REVIEW STUDY

### RECENT RESEARCHES ON AYURVEDIC MANAGEMENT OF ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD) IN CHILDREN- A REVIEW

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## ABSTRACT:

*Attention deficit hyperactivity disorder (ADHD) is a behavioural disorder affecting 5- 10% of Indian population. It is characterized by a persistent pattern of inattention and/or hyperactivity as well as forgetfulness, impulsivity and distractibility. In Ayurveda it occurs due to vitiation dheer, dhriti and smriti that causes imbalance of kala and karma which results into improper contact of the senses with their objectives (Asatmendriyartha samyoga) and give rise to inattention, hyperactivity and impulsivity. Currently available treatment has severe side effects such as loss of appetite, weight loss, tics, mites, social withdrawal. Recent researches in Ayurveda have opened a new gateway in its treatment. Material (research paper of various clinical & experimental studies) for this review paper was collected by open med, pubmed, medlar, Google scholar search engine along with various Ayurvedic text books which concluded that various herbal drugs in single or compound form along with various panchakarma (pentapurification) therapies and yoga are helpful to manage ADHD efficiently.*

**KEY WORDS:** Attention deficit hyperactivity disorder (ADHD), Asatmendriyartha samyoga, Panchakarma

## Introduction

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In present era day to day practice in paediatric field is changed. Now visits of

psychosomatic disorder affected children are increased in paediatric clinics, out of that Attention deficit hyperactivity disorder (ADHD) is one of them which is characterized by a persistent pattern of inattention and/or hyperactivity as well as forgetfulness, poor impulse control or impulsivity and distractibility.<sup>1</sup> 5-10% of

Indian population is affected by this disorder<sup>2</sup> with male predominance.<sup>3</sup> ADHD affected children possess poor learning, peer relationship, below average cognitive functioning, increase rate of school dropouts and learning disabilities. It often continues into adolescence and adulthood and can cause a lifetime frustration and emotional pain. However in Ayurveda neither this disease nor symptoms are described but some references about abnormal behaviour are discussed under features of vata prakriti and unmad (insanity) such as Anavasthita Chittatva, Manovibhrama, Buddhivibhrama, Smritivibhrama, Sheelavibhrama, Cheshtavibhrama, and Acharavibhrama can be correlated with ADHD.<sup>4</sup> Its aetiology is still obscure in modern science while in Ayurveda it occurs due to vibhransh (vitiation) of dheer (rational thinking), dhriti (intellect / retaining power of the mind), smriti (memory) which causes ayoga of kala, karma (abnormality and abnormal conduct) resulting into asatmendriyarthasamyoga (improper contact of the senses with their objectives) and give rise to inattention, hyperactivity and impulsivity.<sup>5</sup> Psycho-stimulant such as methylphenidate, amphetamines and its derivatives are first line drug therapy for ADHD in modern medicine while second lines include Tricyclic antidepressants

(TCA). These drugs improve some academic skills but their side effects such as loss of appetite, weight loss, tics, mites, social withdrawal and obsessive compulsive disorder limits their use. These drugs on prolonged use develop abuses and addiction.<sup>6</sup> Medhya drugs and vata eliminating drug therapies are main stay of treatment of ADHD as aetiopathogenesis points towards involvement of mastishka (brain) and vata dosha (humors). Therefore, drugs which possess nootropic, cognitive, learning aid, neuroprotective & anticonvulsant properties are employed in ADHD to manage clinical features. Ayurvedic herbs in single or compound form show all these properties. Thus with single herb or herbal compound, all the properties needed can be provided to the patients of ADHD along with various panchakarma therapies and yoga which are most effective to improve symptoms found in ADHD. This paper focuses on these evidence based modalities.

### AIMS & OBJECTIVES

- To find out evidence based herbs & other ayurvedic modalities employed in the treatment of ADHD.
- To find out mechanism behind these herbs & ayurvedic modalities to treat ADHD.
- To evaluate a safe, efficacious and side effects free treatment.



## MATERIALS & METHODS

The material for this review paper was collected from the articles searched through open med, pubmed, medlar, Google scholar by using the key words ADHD, ayurveda, shirodhara, nootropic, ashwagandha, bacopa and centella along with Ayurvedic textbooks. All the related research articles, clinical and experimental studies from 1980 to till date were reviewed for the required properties & gathered here into single & groups which are discussed here as:

### NOOTROPIC ACTIVITY

A double-blind placebo-controlled independent group design clinical study was conducted to assess cognitive enhancing effects of the *Bacopa monniera* Linn. (Brahmi) extracts in healthy humans for a period of 90 day in 107 healthy participants. 62 participants completed the study with 80% treatment compliance. Neuropsychological testing using the cognitive drug research cognitive assessment system was conducted at baseline and after 90 days of treatment with a special extract of *Bacopa monniera* Linn. It showed significant improvement in 'working memory' factor more specifically spatial working memory accuracy.<sup>7</sup>

A double blind study of *Centella asiatica* Linn. (Mandukaparni) indicates that there was a significant increase in the general

mental ability of mentally retarded children after 3 months and 6 months of drug administration. In the behavioural area, significant improvement was found in the overall general adjustment and attention & concentration after 6 months.<sup>8</sup>

Another study indicates treatment during postnatal developmental stage with *Centella asiatica* Linn. (Mandukaparni) extract can influence the neuronal morphology and promote the higher brain functions of juvenile and young adult mice.<sup>9</sup>

In a study 50, 100 and 200 mg/kg orally root extract of *Withania somnifera* (L.) Dunal (Ashwagandha) was administered for 6 days in mice receiving chronic electroconvulsive shock (ECS) treatment & results showed significantly improved memory consolidation.

*Withania somnifera* (L.) Dunal administered on day 7 also attenuated the disruption of memory consolidation produced by chronic treatment with ECS. On the elevated plus maze *Withania somnifera* (L.) Dunal reversed the scopolamine (0.3 mg/kg) induced delay in transfer latency on day 1 that shows nootropic like effect in naive and amnesic mice of *Withania somnifera* (L.) Dunal.<sup>10</sup>

Alcoholic and aqueous extracts of *Pueraria tuberosa* DC (Vidarikanda) was evaluated by using elevated plus maze (EPM). A significant reversal effect was

observed on rectal temperature in CIH model, reduction of head twitches in LIH models. The results indicate that nootropic activity observed with tuber extracts of *Pueraria tuberosa* DC could be through improved learning and memory either by augmenting the nor adrenalin (NA) transmission or by interfering with 5-hydroxytryptamine (5-HT) release. Phytoconstituents like flavonoids have been reported for their nootropic effect and these are present in both alcoholic and aqueous extracts of tubers of *Pueraria tuberosa* DC and these active principles may be responsible for nootropic activity.<sup>11</sup>

In an experimental study ethanolic extract of *Evolvulus alsinoides* Linn (Shankhpushpi) and its ethyl acetate and aqueous fractions were evaluated for their memory enhancing & nootropic properties. Two doses (100 and 200 mg/kg per oral) of the ethanol extract and ethyl acetate and aqueous fractions were administered in separate groups of animals. Both doses of all the extracts of drug significantly improved learning and memory in rats. Furthermore, these doses significantly reversed the amnesia induced by scopolamine (0.3 mg/kg).<sup>12</sup>

#### EFFECT ON INATTENTION

A double-blind randomized placebo controlled study was conducted on 36 ADHD affected in which subjects divided

in to two groups viz: 19 children were treated with *Bacopa monniera* Linn. (Brahmi) 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.<sup>13</sup>

A clinical double blind study was carried out on 20 patients to evaluate the effect of *Centella asiatica* Linn. (Mandukaparni). The patients were randomly divided in two groups. Group A patient were treated with Mandukaparni syrup while Group B received Placebo syrup. Mandukaparni syrup provided highly significant results in improving the digit span test of Gujarati Adaptation of Wechsler's Intelligence Scale (GAWISC) and also in relieving inattention, which indicates the capacity of the drug in improving attention and concentration.<sup>14</sup>

#### EFFECT ON LEARNING AID

Alcoholic extracts of *Bacopa monniera* Linn. (Brahmi) was showed improvement in maze learning (learning performance) of rats which is due to saponins bacosides A&B.<sup>15</sup> Three doses (50,100 & 200 mg/kg) of an ethanolic extract of the *Nordostachys jatamansi* Linn. (Jatamansi)

were given to young and aged mice for 8 days. Higher dose among all three showed significant improvement in learning and memory in young mice which was due to facilitation of cholinergic transmission in the brain.<sup>16</sup>

A correlation has been found between improved learning capacity and increased dendritic arborization in amygdaloid nucleus in rat pups after oral administration of fresh plant extract of *Centella asiatica* Linn. (Mandukaparni) in a dose of 2 ml/kg/day for 6 week.<sup>17</sup>

A double blind, randomized and placebo controlled study was conducted on 30 healthy volunteers of age 18-30 years in which they were treated with 500 mg of pure aqueous extract of *Tinospora cordifolia* Wild Mier ex Hook f. (Guduchi) or a matching placebo for 21 days. Learning and memory was assessed by subjecting the volunteers to a battery of psychological tests. *Tinospora cordifolia* Wild Mier ex Hook f. showed a significant ( $p < 0.05$ ) increase in the test scores for 'verbal learning and logical memory'.<sup>18</sup>

### EFFECT ON COGNITION

In a double-blind placebo-controlled study subjects were randomly allocated to one of two treatment conditions, bacopa (300 mg) or placebo. Neuropsychological testing was conducted pre and at 5 and 12 weeks after drug administration. *Bacopa monniera* Linn. (Brahmi) significantly

improved speed of visual information processing measured by the IT task, learning rate and memory consolidation measured by the Auditory Verbal Learning Test (AVLT) and state anxiety compared to placebo, with maximal effects evident after 12 weeks. These findings suggest that *Bacopa monniera* Linn. improve higher order cognitive processes that are critically dependent on the input of information from our environment such as learning and memory.<sup>19</sup>

Alcoholic extracts of *Withania somnifera* (L.) Dunal (Ashwagandha) was administered to rats which slow down locomotors activity, learning behavior, potentiated barbiturate hypnosis due to increased serotonin and histamine levels in brain tissue along with catecholamine's depletion. Thus it induced increase in cortical muscarinic ACH receptor capacity and this explain the cognition enhancing effects of *Withania somnifera* (L.) Dunal (Ashwagandha).<sup>20</sup> To investigate the effects of *Glycyrrhiza glabra* (Madhuyeshti) 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).<sup>21</sup>

## PANCHAKARMA THERAPIES

### Shirodhara

Shirodhara is a method of pouring of cow milk or Tila tail over forehead of patients in the form of a regular stream from a specific height of about 3.14 inches as mentioned in classics in a fixed oscillatory movement for 45 minutes per day for two weeks.

A clinical study was carried in 43 ADHD children satisfying Diagnostic and Statistical Manual of Mental Disorders IV (DSM IV) criteria of both sexes of 6–16 years of age divided into three groups. In group A, 17 patients received syrup Ayurvedic compound I (Contain *Bacopa monniera* Linn. (Brahmi), *Withania somnifera* (L.) Dunal (Ashwagandha) and *Valerian Wallichii* (Tagar); in group B, 14 patients were treated with syrup Ayurvedic compound I + Shirodhara with milk; and in group C, 12 patients received syrup Ayurvedic compound II (placebo). The dose of the drug was 1.0 ml/kg body weight and the duration of treatment was 3 months. Group B showed highly significant improvement while in group C the change was statistically insignificant.<sup>22,23</sup> In a randomized double blind placebo controlled study a formulated Ayurvedic

compound ‘Manas Niyamak Yoga’ has shown statistically significant improvement in the symptoms inattention, impulsiveness and hyperactivity. However, the response was more marked in the children who received drug along with Shirodhara.<sup>24</sup> A double blind placebo control study entitled “Clinical study of the Shishukalyan Yoga and tila tail shirodhara in the management of Attention Deficit/hyperactivity disorder (ADHD) in children” has been carried out 45 ADHD patients satisfying DSM IV criteria equally divided in to three groups- Group A –15 children were received Syrup Shishukalyan yoga I, Group B were treated with Syrup Shishukalyan yoga I + Shirodhara with Tila tail while Group C treated with syrup Shishukalyan Yoga II (Placebo). Shishukalyan Yoga I contain *Bacopa monniera* Linn. (Brahmi), *Acorus calamus* Linn. (Vacha) *Piper Longum* Linn.(Pippali), *Saussurea lappa*(Kushtha), *Hemidesmus indicus* R. Br.(Sariva), *Brassica compestris* (Sidhartaka) Sodium Chloride (Saindhava Lavan) while Shishukalyan Yoga II (Placebo) was a sugar base syrup with same colour and flavour. Group B patient who were with drug Shishukalyan yoga I and tila tail shirodhara had much greater potential to ameliorate the symptoms of ADHD rather than the drug or shirodhara alone.<sup>25</sup>

### Multiple therapies

A study was carried out in the outpatient department (OPD) of Kaumarbhritya, Govt. Ayurveda College, Thiruvananthapuram, during 2007–2008 to assess the efficacy of selected Ayurvedic treatment modalities - that include internal administration of Kalyanaka ghrita, head application of vatasini oil (Shiropichu) and nasal insufflations (Dhmapana Nasya) with Rasnadi churna – in Attention Deficit Hyperactivity Disorder in children of 3-12 years age satisfying DSM-IV diagnostic criteria and randomly distributed into study and control groups. Study group received (1) Kalyanakaghrita (10–20 ml/day internally) and (2) head application of Vatasini taila (Shiropichu), both for 1 month followed by (3) 3 days of nasal insufflations with Rasnadi churna (Dhmapana nasya). Control group received Kushmanda ghrita (efficacy of which has been proved by earlier study) 10–20 ml/day internally for 1 month. The graded responses in both groups were assessed after treatment and follow-up, clinically, and also by using a scale based on Conner's parent rating scale for ADHD. Results showed highly significant effect ( $P < 0.01$ ) in both the groups. Effect in trial group was significantly greater than that of control group both after treatment and follow-up.<sup>26</sup>

### DISCUSSION

Review of various clinical and experimental studies show that Ayurvedic herbal drugs are having cognitive, memory enhancing, nootropic, learning aid, anticonvulsant, neuro-protective properties in single as well as in compound form that brings homeostasis in vitiated tridosha & calm down ADHD symptom.

*Withania somnifera* (L.) Dunal (Ashwagandha) is a good nootropic agent and also promote neuro-regeneration. This herb is well known for its rejuvenating properties.<sup>27</sup> *Bacopa monniera* Linn. (Brahmi) the wonderful nervine tonic possess nootropic and memory enhancing properties. *Asparagus racemosus* Wild (Shatavari) is a good neuro-protector. *Centella asiatica* Linn. (Mandookparni) is nootropic neuro-regenerative and neuroprotective in action. It is necessary to increase the general mental ability, attention and concentration of mentally retarded children. Due to these properties they are more effective to control inattention, hyperactivity and impulsivity of ADHD.

There are many procedures employed to calm down aggravated symptom of ADHD. These procedures are shirodhara, shiropicchu, internal snehana and Dhmapana Nasya which should be performed daily for two weeks and repeated after 7-14 days for three to six months for best results as shown in the



clinical studies reviewed. Shirodhara with milk or tila tail are very effective to control inattention & hyperactive behaviour due to calming effect on mind. In Shiropicchu diffusion of the active ingredients of medicated oil occur through the skin of the anterior fontanel and get circulated all over the brain through the superior sagittal sinus and consequent C.S.F pathway which bring changes in the electric potentials of the brain compartments that lead to regularization of the neurotransmitter mechanism while medicine employed in Dhmapana Nasya stimulate nerve ending of nose which carry information to brain circuit where vitiation of doshas occur. They maintain homeostasis in vitiated doshas of ADHD affected children. Various yogic exercises are essential to children that bring improvements in mood and function.<sup>28</sup>

## CONCLUSION

In a nut shell it is concluded that single or compound herbal drugs alone or with panchakarma procedures provide an ideal solution to ADHD affected children which are absolutely side effect free and calm down parent's anxiety opting modern stimulant medicine. Among all discussed herbs *Bacopa monniera* Linn. (Brahmi) & *Centella asiatica* Linn. (Mandookparni) alone or with shirodhara are proved very potent to control inattention, hyperactivity,

impulsivity and distractibility however more clinical studies are required to establish it in scientific world.

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