



## Yoga and the Therapy of Children with Attention Deficit Hyperactivity Disorder

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### Abstract

Attention deficit hyperactivity disorder (ADHD) is one of the commonest psychiatric disorders in children. Stimulants are frequently used in the management of ADHD. Due to adverse effects of medication there is a growing interest in complementary treatments. Complementary and alternative medicine therapies including yoga are commonly used in children with ADHD, but little is known about the efficacy of these therapies. Yoga requires long periods of concentration and is therefore supposed to reduce attention deficits. The published investigations without a control group report positive effects of yoga on ADHD symptoms and school performance. However, these studies do not allow causal conclusions in regard to the effects of yoga in the treatment of ADHD. The findings from exploratory randomized controlled studies suggest that future research on the efficacy of yoga in ADHD may yield results of therapeutic value. At present the small number of available investigations renders impossible the drawing of any conclusions regarding the effectiveness of yoga for ADHD in children. Large, well-controlled, randomized trials are needed in order to establish the potential value of yoga as a single treatment or adjunct to standard ADHD therapies.

**Keywords:** Attention deficit hyperactivity disorder; Therapy; Complementary and alternative medical therapies; Yoga

### Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most commonly diagnosed neurodevelopmental disorders and affects approximately 6 to 7 % of children and adolescents; ADHD occurs about four times more commonly in boys than girls [1-3]. The characteristic features of children and adolescents with attention deficit hyperactivity disorder (ADHD) are excessive motor activity, inattention, and impulsiveness.

The etiology of ADHD is unknown and appears to be multifactorial. Specific neurobiological correlates of ADHD or biomarkers have not been identified and multiple factors including genetics and environment appear to interact and cause neurobiological liability [4,5]. Some evidence points to a genetic basis of ADHD which is likely to involve many genes with minor individual effects [6]. Pathophysiological alterations associated with ADHD include dysfunctioning of fronto-striatal circuits [7]. The monoamine hypothesis of ADHD postulates a central dysbalance between the actions of the neurotransmitters dopamine, noradrenaline and serotonin [8,9].

First-line treatment options for ADHD include pharmacotherapy, behavioral therapy or both. Stimulant medication is frequently used in the management of ADHD. Methylphenidate, amphetamine salts and slow-release stimulants are the drugs of choice for ADHD treatment [10,11]. Atomoxetine is a non-stimulant drug for ADHD but it is less efficacious than stimulants. Despite the efficacy of medication, many parents seek effective alternative treatments to stimulant drugs for their children due to concerns about the administration of controlled substances or possible adverse effects of medication.

### Complementary and Alternative Medical Therapies for ADHD

Complementary and Alternative Medical (CAM) therapies including yoga are commonly used in children diagnosed with attention deficit hyperactivity disorder, but little is known about the efficacy of these therapies. The frequency of the use of CAM therapies

in children with ADHD ranges between 12 and 64 % [12-14]. CAM treatments in ADHD include electroencephalographic neurofeedback [15], nutritional interventions such as the Feingold diet [16], sugar avoidance [17], elimination of artificial food additives [18], the administration of essential fatty acids [19], vitamins and minerals [20], physiotherapy [21] and yoga.

### Yoga and ADHD

In recent years, meditation has become increasingly popular as a treatment for psychological conditions. There is emerging evidence from randomized trials to support popular beliefs concerning the beneficial effects of yoga in the treatment of neuropsychiatric disorders such as depression or sleep disorders [22]. The long periods of concentration required by yoga are thought to potentially help reduce attention deficits. In addition, yoga may produce a state of calmness and contentment which is lacking in patients with ADHD [23].

A literature search including scientific articles published up until June 2014 was conducted using PubMed, Medline, ERIC and Google Scholar. The search terms used to identify relevant articles included combinations of the following: "Attention Deficit Hyperactivity Disorder", "ADHD", "Yoga", "Complementary and Alternative Medicine" and "CAM". Search results were screened for relevant articles.

Four studies without control/comparison groups on the effects of yoga on children with ADHD have been published [24-27]. In addition, the results of two randomized controlled trials are available in the literature [23,28].

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## Studies Without Control Group

A study by Harrison et al. [24] investigated techniques of Sahaja yoga meditation as a family treatment method for children with ADHD. Parents and children participated in a 6-week program of twice-weekly clinic sessions and regular meditation at home. Pre- and post-treatment assessments included parent ratings of children's ADHD symptoms, self-esteem and child-parent relationship quality. This study reported improvements in children's ADHD behavior, self-esteem and relationship quality. Children described benefits at home such as improved sleep patterns and decreased anxiety, and at school including improved concentration and reduced conflict. Parents reported feeling happier, less stressed and more able to manage their children's behavior [24].

Another approach [25] was to combine yoga/meditation with a multimodal behavioral therapy program for children aged 6 to 11 years. Children were able to successfully learn both yoga and meditation from high school students irrespective of their age, ADHD type, or initial performance impairment. After 6 weeks of the program, 90 % of children showed improvement as measured by their performance impairment score, a measurement of academic performance. Parent and teacher evaluations of behavior also found improvement, e.g. 25 out of 64 children showed an improvement bringing them within the normal range as measured by the Vanderbilt questionnaire [25].

The aim of another study [26] was to assess the efficacy of a one-year, peer-mediated interventional program consisting of yoga, meditation and play therapy maintained by student volunteers in a school in India. The participants were 69 students between the ages of 6 and 11 years, previously identified as having ADHD. The program "Climb-Up" was implemented weekly over one year. The performance impairment scores for ADHD students assessed by teachers improved within 6 weeks and were sustained through 12 months in 46 out of 69 students. The improvements in the Vanderbilt questionnaire scores assessed by parents were observed in 92% of students. Marked improvements in the students' school performance were also sustained throughout the year [26].

An open-label exploratory study [27] investigated the effects of yoga as an add-on intervention in moderate to severe ADHD. Eight boys and one girl with ADHD between 5 and 16 years of age were given yoga training daily during an in-patient stay. All but one was on medication. An average of 8 yoga training sessions was attended by the participants, who were able to learn yoga reasonably well. There was a significant improvement in the ADHD symptoms, as assessed at the time of discharge on the Conners abbreviated rating scale, ADHD-rating scale-IV and clinical global impression-severity [27].

In therapy study designs without a control group, any differences between pre-test and post-test findings are not necessarily due to the treatment. An adequate control group is needed in order to determine whether or not results of an assessment following a treatment are the consequence of the intervention or the natural course of the ADHD symptoms. A regression to the mean may explain the beneficial effects reported in uncontrolled trials in children with the waxing and waning symptoms of ADHD. The studies presented above [24-27] do not therefore allow the drawing of a causal conclusion as to the efficacy of the yoga treatments implemented.

## Randomized Controlled Trials

Two randomized controlled trials have investigated the effects of yoga on ADHD in children [23,28]. In a small exploratory study, Jensen

and Kenny [23] assessed the effects of yoga on the attention and behavior of boys with ADHD whose symptoms were stable on medication. The aim of this study was the assessment of the improvement of ADHD symptoms under a complementary yoga treatment, i.e. additional to that provided by medication and during periods without medication.

Fourteen boys aged 8 to 13 years were assessed according to DSM-IV criteria [29] by specialist pediatricians who used parent and teacher behavior checklists, parent and child interview, and psychometric testing. Eleven boys were diagnosed with ADHD combined type, three with ADHD predominantly inattentive (n=3). Patients diagnosed with comorbid anxiety disorder and learning disability were included, while those with oppositional defiant disorder and conduct disorder were excluded. All participants were stabilized on medication following appropriate periods of titration on dexamphetamine and/or methylphenidate.

In the study by Jensen and Kenny [23], the boys with ADHD were randomly assigned to a 20-session yoga group or a control group with cooperative games and activities. According to ethical requirements all boys were given the opportunity to participate in the yoga program. A crossover design was therefore planned in which boys who had randomly been assigned to the control group were given the opportunity to cross over into the experimental group (yoga) after completion of the first 20-session program.

The yoga program was developed according to Nagendra et al. [30] and Saraswati [31] and comprised standard yoga practices such as respiratory training, postural training, relaxation training, and concentration training [23]. The experimental (yoga) group participated in 20 weekly 1-hour yoga instructional group sessions. In addition, the boys' parents were encouraged to assist with daily practice sessions at home. The control group engaged once a month for one hour in cooperative activities such as talking and listening, sharing equipment and turn-taking. A total of 11 boys completed the yoga program and 8 boys acted as controls.

Boys with ADHD were assessed in an unmedicated state in the morning. A battery of tests was used, including parent and teacher behavior rating scales, a continuous performance task, and motion logs [23]. Significant improvements from pre-test to post-test were found for the yoga, but not for the control group on five subscales of the Conners' Parents Rating Scales (CPRS), i.e. Oppositional, Global Index Emotional Lability, Global Index Total, Global Index Restless/Impulsive and ADHD Index [23]. Significant improvements from pre-test to post-test were found for the control group, but not the yoga group on three CPRS subscales, i.e. Hyperactivity, Anxious/Shy, and Social Problems [23]. Both groups improved significantly on CPRS Perfectionism, DSM-IV Hyperactive/ Impulsive, and DSM-IV Total. In the yoga group, positive change from pre-test to post-test on the DSM-IV Hyperactive-Impulsive subscale of the Conners Teacher Rating Scales (CTRS) was positively correlated with the number of classes attended [23]. Boys in the yoga group who engaged in more home practice showed significant improvement on the Test of Variables of Attention (TOVA) [32] Response Time Variability and greater improvements on the CTRS Global Emotional Lability Subscale [23]. Results from the Motion Logger Actigraph were inconclusive.

Methodological problems of the study by Jensen and Kenny [23] included the small number of participants and the study sample's heterogeneity in regard to the boys' age, ADHD subtype and school placement. The study did not have sufficient statistical power to detect small to moderate differences between the yoga and control groups. In

addition, the boys were assessed on medication by their teachers and off medication by their parents. A major limitation of the study was the 4:1 difference in contact time between the yoga group and the controls which may have resulted in a placebo effect.

The aim of another study [28] was to compare the effectiveness of Hatha yoga in children versus conventional motor exercises (well-known active games) over 34 weeks in a randomized controlled pilot study. Nineteen children aged 8 to 11 years (12 boys and 7 girls) with a clinical diagnosis of ADHD according to ICD-10 criteria (including children with attention disorders, hyperkinetic disorder of social behavior, and not otherwise specified hyperkinetic disorder) were included and randomly assigned to treatment conditions according to a 2x2 cross-over design. Children with severe developmental disabilities were excluded. Eight children were on medication (methylphenidate n=7, pipamperon n=1), seven children were receiving behavior therapy or ergotherapy. For all outcome measures (test scores on an attention task, and parent ratings of ADHD symptoms) the yoga training was superior to the conventional motor training, with effect sizes in the medium-to-high range (0.60-0.97). All children showed reductions in symptoms over time, and at the end of the study, the group means for the ADHD scales did not differ significantly from those of a representative control group. Furthermore, the training was particularly effective for children undergoing pharmacotherapy with methylphenidate. Limitations of the study by Haffner et al. [28] include a small sample size, carry-over effects from the cross-over design and limited follow-up. Neither of the two above studies [23,28] reported adverse reactions in the yoga groups. However, an assessment of potential side effects has not been conducted.

## Conclusion

The published single-arm studies without control group do not allow any causal conclusions regarding the effects of yoga in the treatment of children with ADHD. Although the observations from pilot randomized controlled studies do not provide strong support for the use of yoga for ADHD, partly because these studies were statistically underpowered, they do support further research into its possible use for ADHD. As previously discussed in the literature [33], the small number of available investigations and the high risk of bias across the studies due to design limitations render impossible the drawing of any conclusions regarding the effectiveness of yoga for ADHD in children. Comparisons of yoga in ADHD patients with standard psychotherapy or pharmacological treatment are needed in order to assess the effectiveness of yoga as an add-on or even single treatment option. A general limitation of yoga studies in children with ADHD is the inability to implement double-blind designs. More rigorously designed studies with sufficiently large patient samples should evaluate the efficacy of yoga as an adjunct or sole treatment for ADHD. Limited follow-up periods in the available yoga studies provide no information on the long-term efficacy. The maintenance effects of yoga and the factors influencing long-term outcome (e.g., participants' attitudes and expectations, parental support of home practice, etc.) should also be assessed in the future.

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