THE EFFECTS OF YOGA ON THE BEHAVIOUR OF BOYS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

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ABSTRACT
ADHD is a prevalent behaviour disorder affecting from between 3% – 5% of school age children. Boys are diagnosed with much greater frequency than girls. The current predominant treatment is psycho stimulant medication. In studies of the effects of yoga on other populations, yoga has been found to increase cerebral oxygen metabolism, improve functioning of the right hemisphere, increase alpha waves, improve memory, enhance motor performance and reduce anxiety. All these factors are affected in ADHD. The aim of this study was to investigate the effects of teaching yoga to boys with ADHD as an adjunctive therapy to psycho-stimulant medication.

The subjects (n=17) were boys aged 8-13 years, diagnosed with ADHD by paediatricians specialising in ADHD. Following pre-testing, eligible boys were randomly assigned to either an experimental (yoga) or control (co-operative games) group. The yoga group met once a week with a qualified yoga teacher for up to 20 weeks. The control group met monthly for cooperative games. All participants were pre- and post-tested using the Conners’ Parent Rating Scale - Revised (CPRS – R), Conners’ Teacher Rating Scales - Revised (CTRS – R), and the Test of Variables of Attention (TOVA), which assesses the primary symptoms of ADHD (hyperactivity, impulsivity and attention deficit).

There were significant group by time interactions on two CPRS subscales: Conners’ Global Index Total (F1,16= 7.294, p =.016); and Conners’ Global Emotional Lability (F1,16=8.683, p=.009). In the Conners’ Oppositional Scale there was a trend for group by time interaction (F1,16=4.649, p=.047). On the Conners’ Global Restless/Impulsive subscale, there was a significant main effect for time (F1,16 = 6.058 p=.026) and a trend toward a main effect by time interaction (F1,16=2.165, p =.160). No significant effects were evident in the remaining 10 subscales.

There were no significant group or time differences on either the CTRS-R or the TOVA. Some of the results of this pilot study are promising and warrant further investigation. Methodological difficulties including small sample size, inadequate measures, lack of compliance and monitoring of home practice will need to be addressed in subsequent research.
Attention Deficit Hyperactivity Disorder (ADHD) is a behavioral disorder with an estimated prevalence of 3%-5% in school age children (DSM-IV-1994). Fifty years of research has found neither cause nor cure for ADHD (Cantwell, 1996). However, there is evidence of a strong neurological basis for the disorder with both environmental and genetic factors contributing (Cantwell, 1996). The disorder is more frequent in males, with ratios estimated at between 4:1 and 9:1 (DSM-IV 1994). The disorder follows sufferers into adolescence and adulthood. Those affected often experience social and vocational disadvantage. Secondary problems manifest as academic under-achievement, cognitive impairment, diminished self-esteem and confidence, and social and family dysfunction. ADHD is often comorbid with other disorders such as Learning Disorder (LD), Conduct Disorder (CD), and Anxiety Disorder (AD) (Biederman et al., 1991,1996). This disorder is one of the most frequently occurring childhood psychiatric disorders. The disease burden is considerable, having a far-reaching negative impact on families, schools, and communities.

The most commonly administered treatments for ADHD are pharmaceutical intervention, behaviour modification, cognitive behaviour therapy, and family therapy, often in combination. Although this multi-modal approach is generally regarded as the most effective, behaviour is rarely completely normalised, and 30% of affected children show no response to stimulant medication (Pelham 1993). Neither risk for contact with the judicial system, future social and vocational functioning or academic achievement are positively affected by long term stimulant therapy. There are some disadvantages of pharmacological interventions such as cost and reversal to problematic behaviours when medication is withdrawn.

Yoga is a systematic body of knowledge concerned with the physiological and mental processes that change the physiology of the body through respiratory manipulation (breathing techniques), postures and cognitive control. Bio-physiological data from Positron Emission Tomography (PET), and Quantitative Electroencephalography (QEEG) have demonstrated the effects of yogic breathing on cerebral lateralization (Wernzt 1983), oxygen consumption (Telles & Desarju 1991, Herzog 1990-91, Backon 1988) brain wave activity (Hoffman 1999), cognition (Shanahoff-Khalsa, 1991, Naveen et al., 1997) and emotional states (Rauhalu 1990; Berger 1992). These changes are of potential relevance to ADHD, where slower brain wave amplitudes (Mann al.1991, Clarke et al.,1998), cerebral lateralisation deficits (Heilman, Voeller, Nadeeau 1991), lower oxygen consumption (Zametkin et al 1990), and executive function impairments in adults and children (Barkley, 1996) with ADHD have been reported. Neurotransmitter dysfunction in ADHD is indicated in several studies and the use of medication helps ameliorate this dysfunction (Pliszka et al, 1996). There is also evidence that neurotransmitter activity may be affected by yoga practice (Kennedy, Zeigler & Shannahoff-Khalsa, 1986). Yogic breathing has also been found to improve the symptoms of Anxiety and Obsessive Compulsive Disorders. Anxiety can be a side effect of psycho-stimulant medication and anxiety disorders can be comorbid with ADHD. Like pharmacological intervention, yoga has been found to have a significant influence on neurological activity in a range of clinical and normal populations.

Aim of the study

The primary aim of the study was to evaluate the use of yogic exercises as an adjuvant treatment to pharmacological therapy in reducing the symptoms of ADHD in boys aged 8-13 years.
Methodology

The design was a randomised matched-pairs study with cross-over. The boys assigned to the control group crossed over into the yoga group at the end of the first 20 weeks of intervention. A total of 11 boys completed up to 20 weeks of yoga therapy.

Subjects

Subjects were boys who had been diagnosed by paediatricians who specialise in the management of ADHD and who met all inclusionary criteria, listed below.

1. Aged 8 –13 years.
2. Male
3. Diagnosed with ADHD.
4. Comorbid Oppositional Defiant Disorder and Conduct Disorder.
5. Fluency in English
6. No overt family pathology.
7. Not exposed to other forms of treatment except medication for ADHD
8. IQ in the average range.
9. Able to attend weekly classes.
10. Parental cooperation.

Of the 5 paediatricians specialising in ADHD who were approached for prospective participants, only two agreed to participate. Letters were sent to 80 parents. Of the 25 who responded, 16 began the trials, of whom 14 completed the trials.

Procedures and Setting

Children were assessed on a battery of tests at pre-test, post-test and where relevant, at cross-over. Weekly instructional sessions in yoga took place at the New Children’s Hospital, Westmead. Daily practice sessions were to take place at the home of study participants with the support of parents. The treatment group were taught the techniques as a group for one hour once a week for 20 weeks. The control group engaged in cooperative games sessions once a month over the 20-week treatment period.

Instruments

Measures of behaviour and attention were used to assess boys.

Behavioural Measures

Conner’s Parent Rating Scale –Revised (L) (CPRS-R) (Conners, 1997).
Conner’s Teacher Rating Scale Revised (L) (CTRS-R) (Conners, 1997).

The Conner’s scales address the need for a multi-modal and multi-dimensional approach to assessment of ADHD. In addition to assessing ADHD, the CRS assess behavioural problems such as conduct, anxiety, cognitive and social problems. The scales have acceptable internal consistency (.75 to .90), and 6 - 8 week test-retest reliability coefficients range from .60 to .90.
Test of Variables of Attention (TOVA) (Greenburg, 1991)

This is a continuous performance test designed to avoid confounding attention with language processing skills or short-term memory problems (Greenburg, 1991). It uses relatively short stimulus presentations, relatively short inter-stimulus intervals, and lasts much longer than most CPTs. These characteristics are important because they were parameters identified in Corkum’s and Siegel’s (1993) (cited in Forbes 1998) study as being the conditions that can most likely differentiate ADHD children form normal children. Forbes (1998) reported that TOVA has reasonable sensitivity and specificity; correctly identifying 80% of a sample with ADHD and 72% of a sample without ADHD.

Yoga techniques (Nagendra, Mohan, Shriram 1988)

The proposed yoga program, described below, was developed and trialled successfully in a pilot and feasibility study conducted by the first author. The program incorporates standard yogic practices comprising:

- **Respiratory training**: The respiratory training incorporated selective use of oral and nasal passages for respiratory flow. These exercises increased the boys’ awareness of breath as well as training them to breathe naturally through both nares. All exercises were repeated several times and in a regulated rhythmical manner.

- **Postural Training**: Postural training involved stretching, load bearing, backward, forward, lateral flexion and extensions and inversions performed in sitting, standing, supine and prone positions. These were performed in combination with respiratory exercises.

- **Relaxation Training**: Relaxation training involved exercises to heighten awareness of and to reduce bodily tension by systematically relaxing body parts and tensing and relaxing muscles.

- **Concentration Training**: Concentration training involved a technique called Trataka, which requires participants to focused on a word or shape, followed by seeing the image with eyes closed and continuing to see the image on a blank piece of paper.

**RESULTS**

Boys attended an average of 13 of the 20 classes offered. Boys practised (including classes) 14 days to 116 days. Mean days practised was 54.70 (SD= 40.95) but quality and duration of practice could not be ascertained. Data were analysed using general linear model from the Statistical Package for the Social Sciences (V10).

There were significant group by time interactions on the two of the subscales of the CPRS: Conners Global Index Total (F1,16= 7.294, p=.016); and Conners Global Emotional Lability (F1,16=8.683, p=.009) indicating greater gains by the yoga group at post-test.

On the Conners’ Oppositional Scale (F1,16=4.649, p=.047) and the Conners Global Restless/Impulsive (F1,16=2.165, p =.160) there were trends indicating group by time interactions favouring the yoga group.

On the CTRS there were no significant differences obtained pre and post-test for either group. This null finding may be due to the fact that teachers were assessing the boys at school while under the influence of their medication. (Note that parents assessed their boys at home when the effects of medication had dissipated).

On the TOVA, there was no significant improvement over time nor was there a significant group by time interaction. However, using the TOVA’s ADHD score, three boys in the yoga
group improved and four boys pre-and post-tested within normal limits. Four of the boys returned unreliable scores. In the control group, two boys remained with a score suggestive of ADHD and three remained within normal limits, one improved and one recorded invalid scores at both pre and post test.

**DISCUSSION**
This study investigated the effects of a yoga practice program on the behaviour and attention of boys aged 8-13 years, diagnosed with ADHD, most of whom were already stabilised on medication for ADHD. However, out of school hours, most of the boys were unmedicated. Yoga was therefore treated as both an adjuvant therapy and an additional treatment and the aim was to assess improvement both over and above that provided by medication and during unmedicated periods. A number of outcome measures were employed to assess changes. The Conners’ Parent and Teachers Rating Scales were employed to assess behavioural changes; The Test of Variables of Attention (TOVA)- a continuous performance test was used to assess attention and impulsivity.

Although emotional lability is not considered to be a centrally defining characteristic of ADHD by DSM IV criteria, change in emotional lability (as demonstrated on the Global Index for Emotional Lability) for boys with ADHD can have a significant impact on the manifestation of the disorder. In rating their sons on this dimension, mothers of boys in the yoga group noted reductions in mood swings, temper outbursts and crying fits. The other scale where trends were evident was in the Oppositional Scale. Although Oppositional behaviour is not included in the symptoms list in DSM-1V, Oppositional Defiant Disorder is frequently co-morbid with ADHD (45% -93%) (Jensen et al., 1997). Oppositional behaviour indicates an emotionally volatile state. The items on this scale measure anger, resentfulness; arguing; loss of temper; irritability; defiance towards adults; deliberately annoying behaviour; easily induced annoyance by others; blaming others for his or her mistakes or misbehaviour; spiteful or vindictive behaviour and proneness to fighting. Yoga appears to hold some promise in reducing this troublesome cluster of symptoms.

Although EEG readings were not taken in this study, there are some grounds for conjecture that theta activity may have been reduced by yoga practice. According to Hoffman (1999) theta activity is the predominant wave activity in very young children and for adults, theta waves normally appear during dreaming or drowsiness as well as during strong emotions and also when unconscious memories arise during deep meditation. Theta waves have been measured as the predominant wave activity in ADHD (Clarke et al., 1998). The results of this current study indicating a reduction in emotionally driven behaviour could be grounds for speculating that theta activity could have been reduced. This speculation could only be confirmed in a replication study that employed EEG measures of theta pre and post yoga intervention.

The Conners’ Global Index (GI) combines the two scales of Conners’ Global Emotional Lability (EL) and Conners’ Global Restless/Impulsive (RI). The RI scale measures restless or overactive behaviour; excitability, impulsivity; failing to finish things he or she starts; disturbing other children; inattentiveness and distractibility; and demanding behaviour. Although there was only a trend towards a group by time interaction, this trend is noteworthy because these behaviours are characteristic of ADHD according to DSM1V (1994).
The null results on the remaining 10 scales on the CPRS, on the CTRS and on the TOVA could reflect the true state of affairs or be due, at least in part to methodological problems. The study numbers were small, and perhaps there were too few to provide sufficient power to detect small differences. The sample was more heterogenous than is ideal and considerable individual variability may have obscured possible group effects.

The number of sessions attended varied from five to 19 sessions with a mean of 13.9 sessions. Exposure to the treatment may therefore have been insufficient to produce discernible differences between yoga and control groups on the outcome measures. This number of sessions offered and attended were fewer compared to the length of yoga programs in other studies involving children eg. 5 days a week for 6 months (Telles et al., 1997) where significant results were demonstrated.

Although the boys were familiar with the practices they were asked to do at home, it was not possible to control for compliance, quality of practice, or time spent practising.

The use of Conners Teacher Rating Scales in this study proved problematic. Participants’ teachers changed with the school year and therefore in some cases, the teachers completing the pre- and post- test questionnaires differed. Teachers have different levels of tolerance for different behaviours. For those boys in secondary school (n =3), scales were completed by only one of the many teachers who taught the child and the teachers chosen may not have know the boys well. The fact that teachers rated the boys while they were medicated may also account for the finding that teachers’ ratings of the boys were more favourable than parental ratings at both the pre and post tests, and generally did not differ between boys in the experimental and control groups.

The TOVA appeared to be an unreliable and indiscriminative measure in this study. One third of the yoga group recorded scores on attention falling within the normal range at pre-testing. Given this finding, one could not expect to show a significant improvement as a result of intervention. This factor combined with invalid scores compromised any likelihood of significant improvement in the overall results especially considering the small sample size. The TOVA is not recommended for use in subsequent studies of this kind.

Anecdotal evidence from parents and participants suggested improvements in behaviour. One mother told of the effectiveness of a breathing technique “staircase breathing” that her son had been taught in the yoga class. When her son’s behaviour was escalating into hyperactivity, restlessness and loss of control, she insisted on his using the practice that calmed him. She also noted that on the occasion when he did not do the relaxation in the yoga class, he was more restless in the car, on the way home. One boy reported that he used the relaxation technique to help him sleep. Another mother commented that her son could cope with more than one instruction at a time, had improved memory and was more courteous. She said that she reduced her yelling at him and that he completed his homework without repeated reminders.

CONCLUSION
The use of Yoga as an adjuvant treatment for boys with ADHD appears to have some merit. However this study needs to be replicated with larger numbers before it can be recommended as an effective adjuvant treatment. The results of this study indicated that yoga may contribute
to stabilising the emotions, reducing restless /impulsive behaviour and reducing oppositional behaviour.

REFERENCES
Naveen K.V., Nagarathna R., Nagendra H.R., Telles S. Yoga breathing through a particular nostril increases spatial memory scores without lateralised effects. Psychological Reports, 81: 555 – 561


