IMPACT OF AN INTEGRATED YOGA INTERVENTION ON THE SYMPTOMS OF ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD) IN CHILDREN

BY

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Abstract

“Attention-Deficit Hyperactivity Disorder (ADHD) is a chronic disorder that affects millions of children around the world. The condition may continue into adulthood. ADHD symptoms include difficulty in sustaining attention, hyperactivity, and engaging in impulsive behavior” (Mayo Clinic, 2019).

This study helps to understand whether an integrated yoga practice intervention affects inattentive and hyperactivity/impulsive behavior in children with ADHD. Eight participants in the age group of 6-12 years (mean age 9.1 years) participated in the four-week yoga intervention (3 sessions per week, 45 mins per session) per the defined yoga protocol. Participants' parents completed the “NICHQ Vanderbilt Assessment Scale questionnaire” before and after yoga intervention (NICHQ Vanderbilt, 2002).

The outcome of this study is that pre- and post-intervention results are statistically significant in the Predominantly Hyperactive/Impulsive subtype and ADHD Combined Inattention/Hyperactivity group. The pre- and post-intervention results are not statistically significant in the Predominantly Inattentive subtype. Since the Effect Size (ES) is "Large," the difference between pre and post results is Large.

This study hypothesized that Yoga practice could reduce inattentive and hyperactive behavior symptoms in children with ADHD. Such investigation can be taken up for further scientific research and application of yoga practice for ADHD conditions.

Introduction

Per CDC reporting, “attention deficit hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders among children. It is usually first diagnosed in early stages of childhood and often lasts into adulthood. Children with ADHD may have trouble paying attention, controlling impulsive behaviors (may act without thinking about what the result will be), or be overly active” (CDC, 2021).

The primary symptom of ADHD includes inattentive and hyperactive/impulsive behavior. As reported in the Mayo Clinic report (Mayo Clinic, 2019), “ADHD affects millions of children, and symptoms start at a young age as early as 3 old. ADHD symptoms can be in the spectrum of mild, moderate, or severe, and the condition may continue into adulthood” (Mayo Clinic, 2019).

“ADHD symptoms tend to be more prevalent in males than in females. The behavior can be different among males and females. Males may be more hyperactive and females may be more inattentive” (Mayo Clinic, 2019),

“Children with ADHD may have low self-esteem, and troubled relationships with parents, siblings, and friends. They may perform poorly in academic performance at school. ADHD symptoms sometimes reduce through the development process, and children may outgrow the ADHD symptoms as they become adults. However, some people may not completely outgrow the ADHD symptoms, but they can learn how to deal with and manage symptoms to be successful” (Mayo Clinic, 2019).

In general, ADHD is the inability to control attention. For children with ADHD, it is easy to get distracted. Any new stimulus could easily divert their attention. They tend to find it difficult to focus and ignore other stimuli.

“While there is no cure for ADHD, there are ways to address the symptoms. They are two types of treatments - medications to manage the symptoms and behavioral interventions. Early

diagnosis and the appropriate treatment can make a big difference in addressing symptoms of ADHD" (Mayo Clinic, 2019).

"ADHD has been one of the most difficult psychiatric disorders to treat in children, owing to both the nature of the symptoms, and the controversies regarding the use of stimulant medications, and their adverse effects" (Bir et al., 2016).

"There is research data available on how yoga can help address symptoms of ADHD" (Jensen & Kenny, 2004). A few research papers were reviewed for this study and listed later in the report. "Yoga and meditative practices have therefore been explored as sole or adjunct interventions for ADHD" (Bir et al., 2016).

"Yoga practice can influence sustained attention and discrimination function in children with ADHD" (Chou & Huang, 2017). "Additionally, preliminary efficacy of Mindfulness-Oriented Meditation (MOM) training in children with ADHD has been shown to improve cognitive abilities" (Santonastaso et al., 2020).

Aim

Design and conduct a research study to demonstrate the impact of an integrated yoga practice on children with ADHD symptoms.

Objective

With regular yoga practice, children who are diagnosed with or who exhibit symptoms of ADHD should be able to show sustained and increased attention. It should be able to reduce inattentiveness and hyperactivity, mitigate impulsive behavior, build emotional stability, and improve performance in academic environments.

Literature Review

Ancient, Scripture-based Literature review

Definition of Yoga

Yoga is one of the six Indian philosophical systems known as the *darshanas*, which are Nyāya, Vaiśeṣika, Sānkhya, Yoga, Mīmāṁsā, and Vedānta. The word 'yoga' is derived from the root word 'yuj'. The aim of *yoga* is to bring harmony between body, mind, and consciousness, and to attain *Samadhi* (Self-realization). Yoga can facilitate the individual to achieve a state of freedom from suffering.

The earliest references to Yoga can be found in the Rig Veda dating more than 5000 years ago. Although scholars have traditionally put Rig Vedic time to be 1500 BCE to 1200 BCE, recent scholars have been using the astronomical references used by the late 19th century scholars H.Jacobi and B.G.Tilak who pointed out that based on the vernal equinox in Mrigashira Constellation (Ardra), Rig Veda belongs to a period between 4500 - 2500 BCE (Marin, 2013).

Kathopanishad Upanishads also mention yoga. Sage Patanjali and the Bhagavad Gita reflect the teachings of the Yoga Sutras.

The Kathopanishad defines yoga as:

तां योगमिति मन्यन्ते स्थिरामिन्द्रियधारणाम् ।

अप्रमत्तस्तदा भवति योगो हि प्रभवाप्ययौ ॥2.3.11॥

tāṃ yogamiti manyante sthirāmindriyadhāraṇām .

apramattastadā bhavati yogo hi prabhavāpyayau //2.3.11 //

Meaning: “This, the firm Control of the senses, is what is called yoga. One must then be vigilant; for yoga can be both beneficial and injurious” (Vedatitananda, 2021).

Sage Patanjali in his Yoga Sutras defines yoga as:

योगश्चित्तवृत्तिनिरोधः ॥1.2॥

yogaścittavṛttinirodhaḥ //1.2//

Meaning: Yoga is restraining the mind (Chitta) which is in fluctuating state (Vrittis).

Bhagavad Gita, defines yoga as:
In chapter 2, verse 48:

योगस्थः कुरु कर्माणि सङ्गं त्यक्त्वा धनञ्जय ।

सिद्ध्यसिद्ध्योः समो भूत्वा **समत्वं योग उच्यते** ॥2.48॥

yogasthaḥ kuru karmāṇi saṅgaṃ tyaktvā dhanañjaya

*siddhyasiddhyoḥ samo bhūtvā **samatvaṃ yoga ucyate** //2.48//*

Meaning: Yoga is the state of equanimity, and harmony (shlokam, 2021).

In chapter 2, verse 50:

बुद्धियुक्तो जहातीह उभे सुकृतदुष्कृते ।

तस्माद्योगाय युज्यस्व **योगः कर्मसु कौशलम्** ॥2.50॥

buddhiyukto jahātīha ubhe sukṛtaduṣkṛte

tasmādyogāya yujyasva ***yogaḥ karmasu kauśalam*** *//2.50 //*

Meaning: Yoga is the skillful action to calm the mind and bring awareness in action. Relaxed action is the way work must be performed and its outcome is efficiency (shlokam, 2021).

In chapter 2, verse 53:

श्रुतिविप्रतिपन्ना ते यदा स्थास्यति निश्चला ।

समाधावचला बुद्धिस्तदा योगमवाप्स्यसि ॥ २-५३॥

śrutivipratipannā te yadā sthāsyati niścalā

samādhāvacalā buddhistadā yogamavāpsyasi *//2.53 //*

Meaning: When your intellect, though perplexed by what you have heard, shall stand immovable and steady in the Self, then you shall attain Self-realization (shlokam, 2021).

Yoga-Vasishtha defines yoga as:

मन:प्रशमन उपाय:योग इत्यभिधीयते ॥3-9-32॥

Manah praśamana upāyah yoga ityabhidhīyate //3-9-32 //

Meaning: Yoga is a skillful practice to calm down the mind (shlokam, 2020).

Sri Aurobindo says, **“**Yoga is a systematic conscious effort towards self-development to explore and enhance the latent potentialities of the individual.”

Swami Vivekananda says “Yoga is controlling the senses, will and mind. The benefit of its study is that we learn to control instead of being controlled.”

Pancha Kosha (Five Layers of Existence)

In the Bhrigu Valli, third chapter of the Taittriya Upanishad, the dialogue between Sage Varuna and his son disciple Bhrigu describes the concept of five layers of existence within every individual, called *Pancha Kosha*. “*Pancha”* means “five” and “*kosha*” refers to “attributes or layers” *(Nagarathna & Nagendra, 2011).*

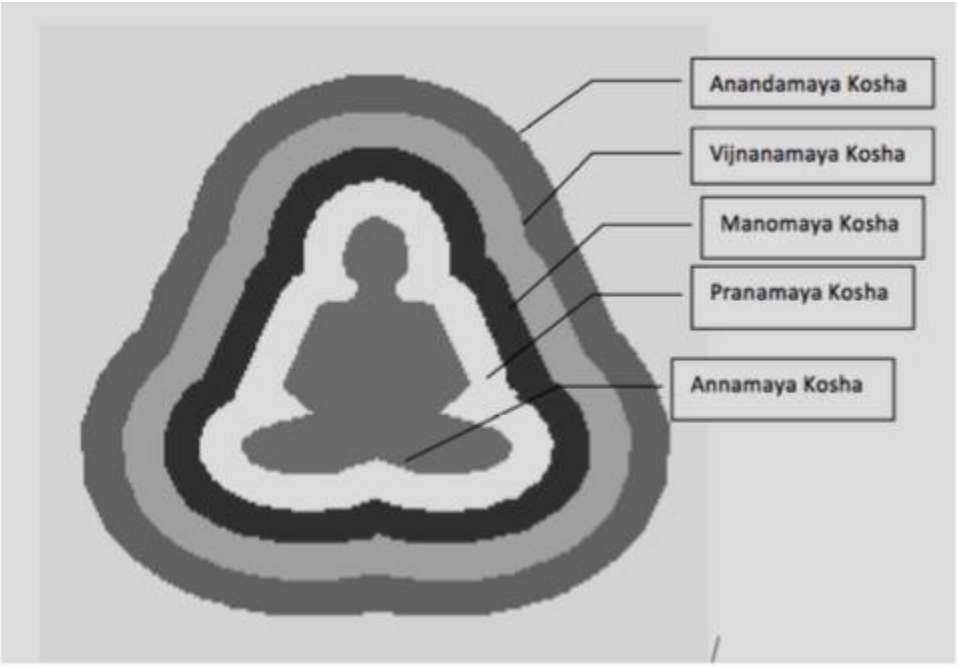

Figure 1

As shown in Figure 1,

1. ***Annamaya Kosha*** is the physical layer. This matter-based layer is made up of the elements and nourished by the food and nutrients that we consume.

2. ***Pranamaya Kosha*** is the layer of life force or energy. *Prana* is the energy from which the physical body manifests itself. A uniform, harmonious flow of *prana* to all the cells of the physical body keeps one alive and healthy.
3. ***Manomaya Kosha*** is the emotional layer of our personality with likes and dislikes as the primary reaction to different emotions. It is the portion of our consciousness that deals with perception (*Manah*), memory (*Citta*) and ego (*Ahankara*). It also engages with the emotions that are the root cause of all human joy and distress. The *Manomaya Kosha* is our mental and emotional library, a subtler layer of our existence.
4. ***Vijnanamaya Kosha*** is the layer of intellect. It is the consciousness that continuously guides us in all our actions. It guides the *manomaya kosha* to attain mastery over basic instincts. For example, when one smells one's favorite food, the mind instructs to grab and eat it. But the intellect reminds one that today is a fasting day.
5. ***Anandamaya Kosha*** is the layer of bliss. It is the highest stage of evolution in manifested existence. While in the *Manomaya Kosha*, creative power predominates, whereas the power to discern and discriminate is central in the *Vijnanamaya Kosha*. However, bliss is the most subtle of the five layers of existence.

Optimal health is achieved when there is complete harmony and balance among all these five aspects of our personality. In one's journey towards achieving harmony and happiness, the practitioner includes the concept of pancha kosha in daily routine. Ill health is when we move away from our true Self. When there are imbalances in one of the layers, the effects are seen in the other layers as well *(Nagarathna & Nagendra, 2011)*.

Pancha Kosha and Diseases (Vyadhi)

Yoga Vasishta is an ancient text consisting of the conversation between Sage Vasishta and Lord Rama. Here, the concept of disease and its relationship to the mind is explained. When we get caught up in emotions, the speed of the mind increases, and we lose the ability to discriminate between right and wrong. This leads to imbalances called *Adhi* (stress). Due to heightened speed of the mind, prolonged stress percolates into the *Annamaya Kosha* through the *Pranamaya Kosha* causing *Vyadhis*, or illnesses. Hence, to address these psychosomatic ailments, it becomes necessary to work at all levels (*Pancha Kosha*) of our personality to bring about holistic healing.

In *Anandamaya Kosha*, one is healthiest with perfect harmony and balance of all the faculties established. In *Vijnanamaya Kosha*, although there is activity, our faculty of discernment helps in channeling our actions in the right direction, resulting in positive and ethical actions. According to Maharshi Vasishta, imbalances start in the *Manomaya Kosha*. Ignorance (*ajnana*) leads one towards poor diet, unhealthy conditions, and overexertion of oneself. These actions cause physical diseases. To be healthy, one needs to be in a natural balanced state within and between all the layers of our personality. Yoga, with its integrated approach, offers a natural path to reach this balanced state *(Nagarathna & Nagendra, 2011)*.

The *Adhija Vyadhis* (primary diseases) are *Sara* (essential) and *Samanya* (ordinary). *Samanya Vyadhi* includes the disorders caused by usual stress or lifestyle problems that are not genetic in nature. *Sara Vyadhi* includes congenital disorders or the ailments that result due to our genetic predisposition. These are termed as psychosomatic ailments.

Yoga helps overcome *Adhija Vyadhis*. The subtler adhis of type *Sara* (essential) which are congenital in nature can be addressed by the realization of the causal states of mind and a

corresponding ability to live in *Vijnanamaya* and *Anandamaya Kosas (Nagarathna & Nagendra, 2011)*.

To summarize, there are two types of diseases:

- *Adhija Vyadhi*: Stress-born psychosomatic ailments.
- *Anadhija Vyadhi*: Illnesses of injuries which occur because of any external cause such as an accident, infection, injury, toxins, etc.

There are two types of Adhija Vyadhi:

- *Sara Adhija Vyadhi*: Ailments which are influenced by heredity.
- *Samanya Adhija Vyadhi*: Ailments which are not inherited.

Scientific literature review

The following scientific literatures have been reviewed for this study.

"Effects of an 8-week yoga program on sustained attention and discrimination function in children with attention deficit hyperactivity disorder" (Chou & Huang, 2017).

"This study investigated whether a yoga exercise intervention influenced the sustained attention and discrimination function in children with ADHD. Significant improvements in accuracy rate and reaction time of the two tests were observed over time in the exercise group compared with the control group. These findings suggest that alternative therapies such as yoga exercises can complement behavioral interventions for children with attention and inhibition problems. Schools and parents of children with ADHD should consider alternatives for maximizing the opportunities that children with ADHD can engage in structured yoga exercises" (Chou & Huang, 2017).

“Clinical Application of Mindfulness-Oriented Meditation: A Preliminary Study in Children with ADHD” (Santonastaso et al., 2020).

“This study tested the preliminary efficacy of MOM training in children with ADHD by comparing its efficacy with an active control condition (Emotion Education Program, EEP). On average, MOM training had positive effects on neuropsychological measures, as evidenced by a significant mean improvement in all outcome measures after training. Moreover, positive effects on ADHD symptoms were found only in the MOM group. Although they are preliminary, the results documented that MOM training promotes changes in neuropsychological measures and specific behavioral symptoms, suggesting it is a promising tool for facilitating cognitive and clinical manifestations of ADHD” (Santonastaso et al., 2020).

“The effects of yoga on the attention and behavior of boys with Attention-Deficit/ hyperactivity Disorder (ADHD)” (Jensen and Kenny, 2004).

“In this study, boys diagnosed with ADHD by specialist pediatricians and stabilized on medication were randomly assigned to a 20-session yoga group (n = 11) or a control group (cooperative activities; n = 8). The results showed 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): Oppositional, Global Index Emotional Lability, Global Index Total, Global Index Restless/Impulsive, and ADHD Index. Although these data do not provide strong support for the use of yoga for ADHD, partly because the study was underpowered, they do suggest that yoga may have merit as a complementary treatment for boys with ADHD already stabilized on medication, particularly for its evening effect when medication effects are absent. Yoga remains an investigational treatment, but this study supports further research into its possible uses for this population. These findings need

to be replicated in larger groups with a more intensive supervised practice program" *(Jensen and Kenny, 2004).*

"Effect of Bhramari Pranayama on response inhibition: Evidence from the stop signal task" (Rajesh et al., 2014).

"The study examined the effect of Bhramari Pranayama (Bhpr) on response inhibition in healthy individuals. The study hypothesized that improvement in response inhibition might be due to enhanced theta activity. Further, it is possible to use this breathing technique as an adjunct for the management of ADHD. More studies are required for the use of this technique in clinical cases. The study is limited by the small sample size, and the lasting effect of the intervention was not assessed. Future studies should incorporate various assessment methods to capture changes while performing the task and intervention to understand the underlying mechanism" *(Rajesh et al., 2014).*

"Effects of Yoga on Attention, Impulsivity, and Hyperactivity in Preschool-Aged Children with Attention-Deficit Hyperactivity Disorder Symptoms" (Cohen et al., 2018).

"Studies support yoga for school-aged children with ADHD; this study evaluated yoga in preschoolers on parent- and teacher-rated attention/challenging behaviors, attentional control (Kinder Test of Attentional Performance [KiTAP]), and heart rate variability (HRV). This randomized waitlist-controlled trial tested a 6-week yoga intervention in preschoolers with ≥4 ADHD symptoms on the ADHD Rating Scale-IV Preschool Version. Group 1 (n = 12) practiced yoga first; Group 2 (n = 11) practiced yoga second. We collected data at 4 time points: baseline, T1 (6 weeks), T2 (12 weeks), and follow-up (3 months after T2). Yoga was associated with modest improvements on an objective measure of attention (KiTAP) and selective improvements on parent ratings" *(Cohen et al., 2018).*

“An evaluation of yoga and meditation to improve attention, hyperactivity, and stress in high-school students.” *(Saxena et al., 2020).*

“In this study, we examined the impact of Hatha yoga on attention and stress in ninth graders. The Yoga Group (YG) participated in 25-min Hatha yoga classes twice weekly over 12 weeks (n = 123). The Control Group (CG) included 51 students. Student self-reports on measures of inattention and hyperactivity (the strengths and weaknesses of ADHD [attention-deficit/hyperactivity disorder] symptoms and normal behavior rating scale for ADHD) and stress (perceived stress scale) were obtained at baseline and at 12 weeks. There were no significant differences in baseline levels of inattention ($p = 0.86$), hyperactivity ($p = 0.25$), and perceived stress ($p = 0.28$) between the YG and CG. Regarding inattention scores, there was a significant interaction of group and time ($b = -1.09$, standard error [SE] = 0.30, $p < 0.001$). Pairwise *t*-tests showed a significant reduction in inattention for the YG ($d = 0.27$) but a significant increase in inattention for the CG. Regarding hyperactivity, there was no significant interaction of group and time ($b = -0.43$, SE = 0.26, $p = 0.1$). Pairwise *t*-tests demonstrated a significant reduction in hyperactivity for the YG ($d = 0.22$), but not the CG. The interaction of group and time was not significant in predicting the slope of change in perceived distress ($b = -0.93$, SE = 1.19, $p = 0.43$). Pairwise *t*-tests did not show a significant reduction in perceived distress for either group. These findings suggest that Hatha yoga may improve attention and hyperactivity in high school students” *(Saxena et al., 2020).*

“Feasibility and efficacy of yoga as an add-on intervention in attention deficit-hyperactivity disorder: An exploratory study” *(Hariprasad et al., 2013).*

"To study the effects of yoga as a complementary therapy in children with moderate to severe ADHD. The study was performed on children (consent was taken from parents) admitted in a child psychiatry unit using an open-label exploratory study. Children between 5 and 16 years of age diagnosed with ADHD and co-operative for yoga were included. Subjects with other serious psychiatric and medical illnesses were excluded. The participants were given yoga training daily during their in-patient stay. A total of 9 children (8 males, 1 female) were recruited into the study. An average of 8 yoga training sessions was given to subjects. They were able to learn yoga reasonably well. There was a significant improvement in the ADHD symptoms as assessed on CARS (P-0.014), ADHD-RS IV (P=0.021) and CGI- S scales (P=0.004) at the time of discharge." *(Hariprasad et al., 2013).*

Various Articles and Key Findings on ADHD documented on the CDC website. (CDC, 2021)

CDC website includes various Key Findings, Featured articles and Scientific Articles about ADHD.

Rationale of the Study

Pancha Kosha concept and its application as explained in the ancient scriptures helps to bring equanimity to mind and helps to deal with Stress-born psychosomatic ailments (*adhija vyadhi).* Since ADHD is a psychiatric disorder and directly related to the mind, yoga helps calm down the mind.

Also, scientific literature on yoga practice as an intervention method confirms that yoga helps children with ADHD. The ADHD population is growing, and many parents of ADHD children may not be aware that yoga can be used as a complementary method to treat ADHD conditions. Hence, this study is taken up.

Ethical consideration

This study did not have known or perceived risk to participating in this study at the physical or psychological level. Participants may withdraw their participation at any time. Informed consent was obtained through an online consent form in English. Participants were uniquely identified for communication via their names, parents' names, and email addresses.

After data collection, the names and email addresses were stripped from the dataset and replaced with a unique identifier number. Aggregate results are made available in this study report.

Participants were given a link to an online Google form which included a questionnaire for data collection. Only the researcher had access to the data on Google Forms. Google Forms provides password protection for researcher accounts to access all their survey information.

Study Design

Study Population

Eight participants were recruited via various mail and WhatsApp groups and flyers posted on Facebook. Some participants were referred by their physician. All the participants were in the age group of 6-12 years and clinically diagnosed with ADHD by their physician or psychiatric physician or exhibiting symptoms of ADHD in the past six months. Three subtypes of ADHD i.e., inattentive, hyperactivity/impulsivity, and combined were included in the study.

Inclusion criteria

Male and female children in the age group of 6-12 years were clinically diagnosed with ADHD or exhibiting symptoms of ADHD and not practicing any form of yoga.

Exclusion criteria

Children with ADHD who have practiced yoga, mindful practices and taking medications in the past six months.

Demography

Participants were recruited from the San Francisco Bay area for in-person yoga sessions. Participants from remote locations in the USA attended yoga sessions online over Zoom.

All participants were subdivided into three groups based on their age and demography. Group 1 included participants in the age group 6 to 8 years, Group 2 included participants who could attend in-person sessions, and Group 3 included remote participants who participated in the yoga sessions online over Zoom.

Hypothesis

Yoga practice will help to reduce inattentive and hyperactive behavior symptoms in children.

Null Hypothesis

Following are null hypotheses stated for this study:

1. Yoga practice will have no impact on predominantly inattentive behavior in children.
2. Yoga practice will have no impact on predominantly hyperactive / impulsive behavior in children.
3. Yoga practice will have no impact on ADHD combined Inattentive, hyperactive behavior in children.

Confounding Factors

The confounding factors in this study could be the other psychiatric comorbidities, autism spectrum disorder and side effects of the medication. Confounding factors were addressed to some extent by exclusion criteria.

Design

The parents signed written informed consent. Parents attended an information session where the full explanation of the study was presented to the parents, which was reviewed, and approved by the Institutional Review Board (IRB) before the start of the study.

Participants' parents were asked to complete a pre-intervention NICHQ Vanderbilt Assessment Scale online questionnaire to assess the scale of ADD and ADHD symptoms at the beginning of the study.

Participants attended in-person and online yoga sessions of 40 minutes at least 3 days per week for 4 weeks.

During the intervention period, participants' yoga session attendance was recorded in an online log noting the date of their yoga practice.

After the intervention period (4 weeks), the participants' parents were asked to complete a post-intervention NICHQ Vanderbilt Assessment Scale online questionnaire to assess the impact and any changes in their cognitive abilities.

Description of ADHD

There are three subtypes of ADHD (CDC, *Learn about ADHD* 2021):

- **Predominantly inattentive.** Most symptoms fall under inattention. “It is hard for the individual to organize or finish a task, pay attention to details, or follow instructions or conversations. The person is easily distracted or forgets details of daily routines” (CDC, *Learn about ADHD* 2021).
- **Predominantly hyperactive/impulsive.** Most symptoms are hyperactive and impulsive. “The person fidgets and talks a lot. It is hard to sit still for long (e.g., for a meal or while doing homework). Smaller children may run, jump, or climb constantly. The individual may feel restless and has trouble with impulsivity. Someone impulsive may interrupt others a lot, grab things from people, or speak at inappropriate times. It is hard for the person to wait their turn or listen to directions. A person with impulsiveness may have more accidents and injuries than others” (CDC, *Learn about ADHD* 2021).
- **Combined.** Includes both inattentive symptoms and hyperactive/impulsive symptoms (CDC, *Learn about ADHD* 2021).

Inattention

A child who shows a pattern of inattention may often (Mayo Clinic, 2019).

- Fail to pay close attention to details or make careless mistakes in schoolwork
- Have trouble staying focused on tasks or play
- Appear not to listen, even when spoken to directly
- Have difficulty following through on instructions and fail to finish schoolwork or chores
- Have trouble organizing tasks and activities

- Avoid or dislike tasks that require focused mental effort, such as homework
- Lose items needed for tasks or activities, for example, toys, school assignments, pencils
- Be easily distracted
- Forget to do some daily activities, such as forgetting to do chores

Hyperactivity and impulsivity

A child may exhibit following hyperactive and impulsive symptoms (Mayo Clinic, 2019).

- Fidget of hands and legs, twists the body in the seat
- Having trouble staying seated at one place
- Constantly moving or running around
- climbs inappropriately
- Having trouble staying quiet
- Blabbers or blurt out interrupting the speaker or conversation
- Cannot waiting for the turn to respond
- Interrupts games, activities where involved

Typical developmental behavior vs. ADHD

"Most healthy children are inattentive, hyperactive, or impulsive at one time or another. It's typical for preschoolers to have short attention spans and cannot stick with one activity for long. Even in older children and teenagers, attention span often depends on the level of interest.

The same is true of hyperactivity. Young children are naturally energetic — they often are still full of energy long after they've worn their parents out. In addition, some children just naturally

have a higher activity level than others do. Children should never be classified as having ADHD because they're different from their friends or siblings.

Children who have problems in school but get along well at home or with friends are likely struggling with something other than ADHD. The same is true of hyperactive or inattentive children at home, whose schoolwork and friendships remain unaffected" (Mayo Clinic, 2019).

Assessment Tools

Health care professionals use the NICHQ Vanderbilt Assessment Scales to help diagnose ADHD in children between 6- and 12-years. (NICHQ Vanderbilt, 2002).

For this study, the NICHQ Vanderbilt Assessment Scale - PARENT Informant part of the assessment scale is used to assess ADHD behavior in children.

Here is a link to the questionnaire template.

https://www.nichq.org/sites/default/files/resource-file/NICHQ-Vanderbilt-Assessment-Scales.pdf

In NICHQ Vanderbilt ADD/ADHD assessment questionnaire, there are 55 questions categorized in the following subsections.

Questions 1 to 9 evaluate predominantly Inattentive subtype.

Questions 10 to 18 evaluate predominantly Hyperactive/Impulsive subtype.

Questions 19 to 26 evaluate Oppositional-Defiant Disorder Screen.

Questions 27 to 40 evaluate Conduct Disorder Screen.

Questions 41 to 47 evaluate Anxiety/Depression Screen.

Questions 48 to 55 evaluate Performance of the child.

Questions 1 to 47 responses include 4 choices.

0 - Never

1 - Occasionally

2 - Often

3 - Very Often

Performance questions 48 to 55 responses include 5 choices.

1- Excellent

2- Above Average

3 - Average

4 - Somewhat of a Problem

5 - Problematic

The following assessment scale is used for assessing the ADHD condition (NICHQ Vanderbilt, 2002).

1. Predominantly inattentive subtype
    - Must score a 2 or 3 on 6 out of 9 items on questions 1–9 AND
    - Score a 4 or 5 on any of the Performance questions 48–55
2. Predominantly hyperactive/impulsive subtype
    - Must score a 2 or 3 on 6 out of 9 items on questions 10–18 AND
    - Score a 4 or 5 on any of the Performance questions 48–55
3. ADHD combined Inattention/Hyperactivity
    - Requires the above criteria on both inattention and hyperactivity/impulsivity

4. Oppositional-Defiant Disorder Screen

- Must score a 2 or 3 on 4 out of 8 behaviors on questions 19–26 AND
- Score a 4 or 5 on any of the Performance questions 48–55

5. Conduct Disorder Screen

- Must score a 2 or 3 on 3 out of 14 behaviors on questions 27–40 AND
- Score a 4 or 5 on any of the Performance questions 48–55

6. Anxiety/Depression Screen

- Must score a 2 or 3 on 3 out of 7 behaviors on questions 41–47 AND
- Score a 4 or 5 on any of the Performance questions 48–55

In this study, inattentive, hyperactive/impulsive subtypes, and ADHD combined inattention/hyperactivity group scores (items 1,2, and 3) are used for statistical analysis.

Intervention, Yoga Practice Protocol

Integrated yoga practice includes:

- Breath and Body practices – 5 mins

  These practices help to regulate breathing, develop awareness about breathing mind and body through the movements of different parts of the body, activate the lungs to utilize all the lobes and increase lung capacity fully, normalize the breathing rate, make the breathing uniform, continuous and rhythmic, and synchronize breath and motion.

- Dynamic practices – 10 mins

  When practiced as dynamic yoga, loosening practices remove the lethargy and laziness in the body and warm up the body. These practices are very effective in helping with obesity, anxiety,

depression, and overall positive health. Given the dynamic nature of these practices, children benefit because of their stimulative effects.

    - Sun salutation (SN)
    - Yogic games

- Yoga Asanas (poses) – 10 mins

  Asanas are popularly known as Yoga postures, positions, or poses. Asanas are techniques to bring about profound rest to different body parts. Asanas are postures maintained with ease and stability for an extended period. The surface muscles (limb and trunk) are stretched or contracted to achieve the final posture. After getting to the final posture, one relaxes all the prior contractions and feels the body changes due to pose, the heart rate, breathing, and muscle relaxation. Asana practice brings flexibility and stability to the body and develops focus and concentration in the mind.

    - Balancing asanas (for focus and concentration)
    - Inversion asanas

- Pranayama (breath regulation practices) – 5 mins

  Pranayama means mastery over the life force. We achieve this using breathing practices. Pranayama means regulating or controlling the vital life force (prana) through breathing practices, as breath is a bridge between body and mind. Pranayama becomes a natural first step to preparing for meditation practice.

    - Left and alternate nostril breathing
    - Humming sound/vibration

- Relaxation Techniques – 5 mins

There are many ways to relax by listening to music, walking in the park, gardening, biking, or simply sleeping. While all these give rest to the stressed-out mind, sleep provides rest to both mind and body; nothing helps us relax as deeply as yogic relaxation because this gives us a wakeful state of relaxation. A deep (Progressive muscle) Relaxation Technique with A, U, M and AUM chanting was practiced.

- Guided Meditation and chanting – 5 mins

  The mind mainly works through visual and verbal thoughts (visual and verbal mind). While visual aids and visualization techniques can be used to calm the visual mind, sounds and patterns with different frequencies, chanting, and songs can be used to calm the verbal mind. Meditation can be based on breath or visual and sound patterns.

  - Visual/gazing meditation (Trataka)
  - Sound/Resonance meditation (A.U,M, AUM sounds with silence)

Data Collection

NICHQ Vanderbilt ADD/ADHD assessment questionnaire (parents' version) was used to create a Google form. Participants' parent(s) completed the questionnaire during the pre- and post-intervention period.

Link to the sample Google form:

https://docs.google.com/forms/d/1ayYkP9J_q99dySp0UVFtRnaf5HN-eJCJbNyY9y8hx2g/edit?ts=61d353ed

A qualitative method was used to record input provided by parents about any change in participant's behavior not covered in the questionnaire.

Each participant's yoga session attendance was recorded for compliance purposes.

Data Analysis and Results

Figure 2 below shows how many participants are in the age group.

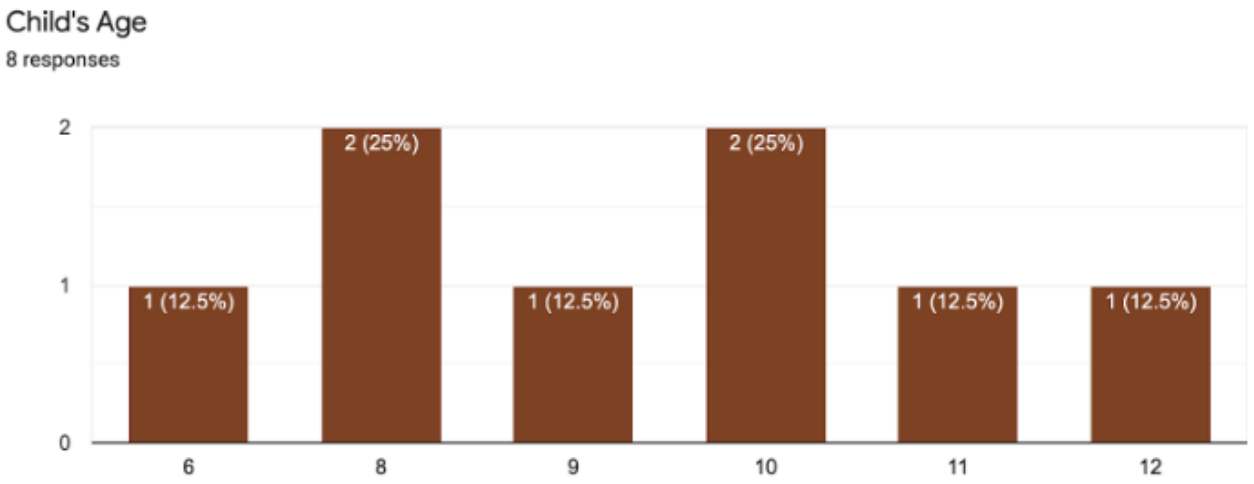

Figure 2

Figure 3 below shows the % of Male vs Female participants.

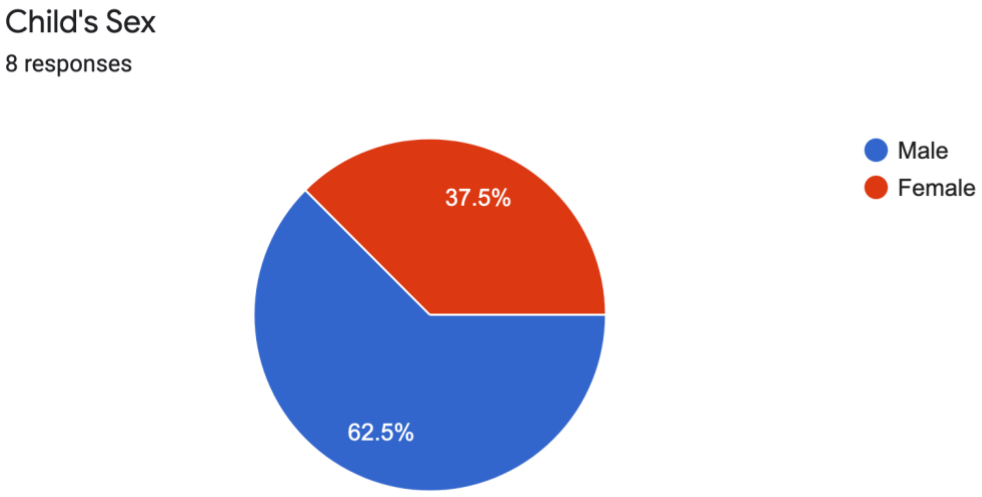

Figure 3

Figure 4 below shows each participant pre- and post- results of predominantly inattentive behavior.

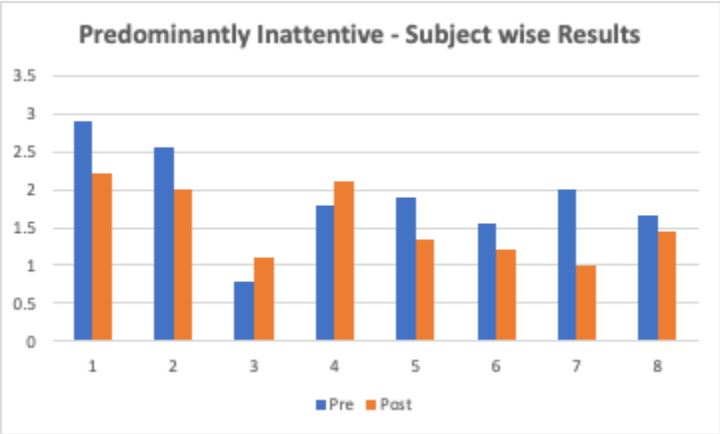

Figure 4

Figure 5 below shows each participant pre- and post- results of predominantly hyperactive/impulsive behavior.

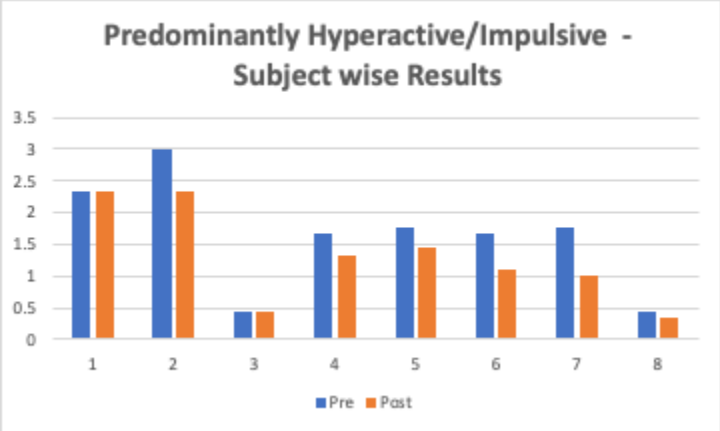

Figure 5

Figure 6 below shows each participant pre- and post- results of ADHD combined inattentive/hyperactive behavior.

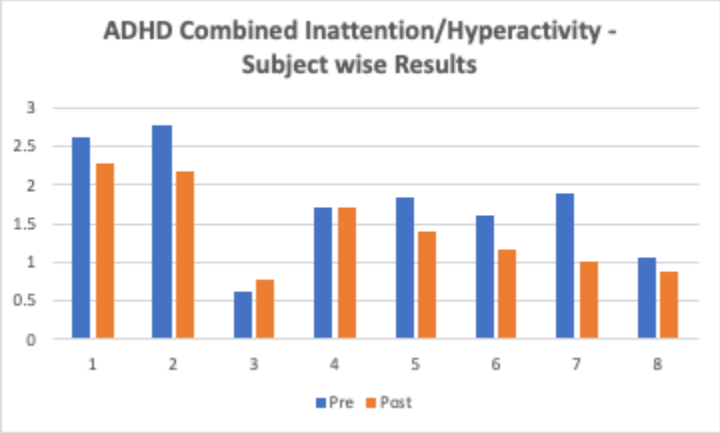

Figure 6

Figure 7 below shows Summary graph of pre and post results of each category of ADHD subtypes and combined ADHD behavior.

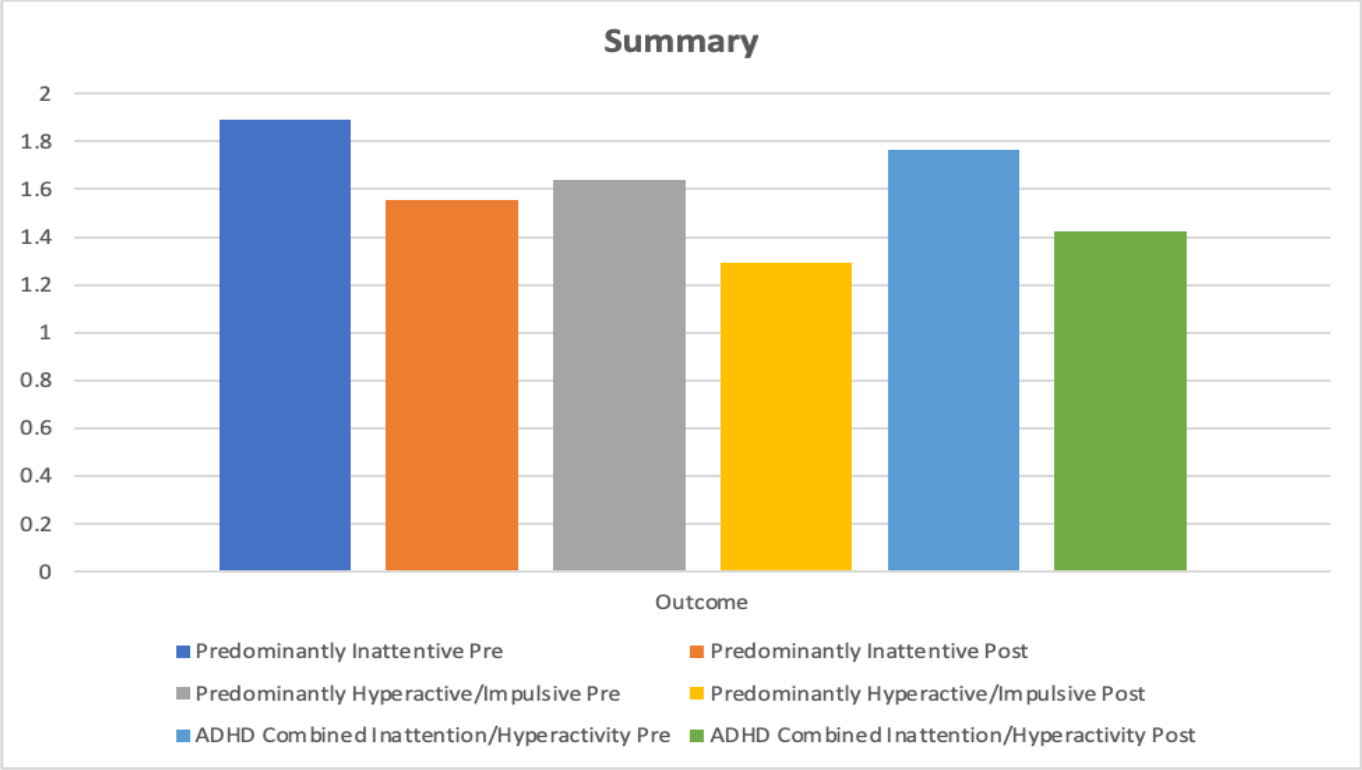

Figure 7

Statistical Analysis

For Statistical analysis, Predominantly Inattentive subtype questions Q1 to Q9 are listed as D1Q1 to D1Q9 Pre and Post results. Similarly, Predominantly Hyperactive/Impulsive subtype questions Q10 to Q18 are listed as D2Q10 to D2Q18 Pre and Post results.

D3Pre and Post are ADHD Combined Inattention/Hyperactivity Pre- and post-intervention results.

D1, D2, and D3 Pre and Post for each subject are summed up for data analysis as D1PreSum and D1PostSum; D2PreSum and D2PostSum; D3PreSum and D3PostSum.

The data is captured, and Sum is calculated in an Excel Spreadsheet. The data in Spreadsheet is imported and analyzed using the Statistical Analysis tool "JASP".

Descriptive Statistics

Figure 8 below shows Descriptive statistics Mean, Standard Deviation (SE) of Pre and post results of each category of ADHD subtypes and combined ADHD behavior. In the Predominantly Inattentive (D1) subtype, the Mean value dropped from 17 to 14.375, and SD dropped from 5.757 to 4.565.

In the Predominantly Hyperactive/Impulsive (D2) subtype, the Mean value dropped from 14.75 to 11.625, and SD dropped from 7.778 to 6.76.

In the ADHD Combined Inattention/Hyperactivity (D3), the Mean value dropped from 10.00 to 6.75, and SD dropped from 7.521 to 6.251.

Descriptive

	N	Mean	SD	SE
D1PreSum	8	17.000	5.757	2.035
D1PostSum	8	14.375	4.565	1.614
D2PreSum	8	14.750	7.778	2.750
D2PostSum	8	11.625	6.760	2.390
D3PreSum	8	10.000	7.521	2.659
D3PostSum	8	6.750	6.251	2.210

Figure 8

Inferential Statistics

Since the same participants underwent pre-intervention and post-intervention assessments, the study design is "within group". To test normality as part of assumption checks, the Shapiro Wilk test was selected.

As shown in the Figure 9 below, the Shapiro Wilk test, the p-value is > 0.05, cannot reject Null Hypothesis. Hence, it can be concluded that the data is normally distributed.

Test of Normality (Shapiro Wilk) calculations are listed below:

Assumption Checks

Test of Normality (Shapiro-Wilk)

			W	p
D1PreSum	-	D1PostSum	0.938	0.587
D2PreSum	-	D2PostSum	0.918	0.413
D3PreSum	-	D3PostSum	0.933	0.541

Note. Significant results suggest a deviation from normality.

Figure 9

When data is normally distributed, a parametric Test is used.

For within group, a Paired Sample T-Test is used as a parametric test.

In Figure 10 below, The Paired Samples T-Test calculations are listed:

Paired Samples T-Test

Measure 1		Measure 2	t	df	p	Cohen's d
D1PreSum	-	D1PostSum	1.779	7	0.118	0.629
D2PreSum	-	D2PostSum	3.279	7	0.014	1.159
D3PreSum	-	D3PostSum	2.763	7	0.028	0.977

Note. Student's t-test.

Figure 10

In the Predominantly Inattentive (D1) subtype, p-value is 0.118 which is > 0.05 Alpha value. Due to this condition, concludes failing to reject the null hypothesis "Yoga practice will have no impact on predominantly Inattentive behavior in children". Hence, the pre- and post-intervention results are not statistically significant. But Cohen's d value for D1 subtype is 0.629, D2 subtype is 1.159 and D3 group is 0.977 which means the Effect Size (ES) is "Large" for all the three groups. It means the difference between pre and post results of the Inattentive (D1), Hyperactive (D2) and Combined ADHD (D3) subtypes is Large, even though it is not statistically significant in D1 subtype.

In the Predominantly Hyperactive/Impulsive (D2) subtype, p-value is 0.014 which is < 0.05. When the p-value is less than Alpha, it rejects the null hypothesis "Yoga practice will have no impact on predominantly Hyperactive, Impulsive behavior in children. Hence the pre- and post-intervention results are statistically significant.

In the ADHD Combined Inattention/Hyperactivity (D3), p-value is 0.028 which is < 0.05. When the p-value is less than Alpha, it rejects the null hypothesis "Yoga practice will have no impact on ADHD Combined Inattentive/Hyperactive behavior in children". Hence, the pre- and post-intervention results are statistically significant.

The alternate hypothesis "Yoga practice will help reduce inattentive and Hyperactive behavior symptoms in children" holds to be true.

Observations

The following pre- and post-assessment observations are recorded as provided by participants' parents.

Subject #1:

- Pre-assessment: Child lacks focus on paying attention to details, appetite is good, screams, shouts, and throws tantrums when she doesn't like something. This is a strong exhibition of the Inattentive, and hyperactive behavior.
- Post assessment: In an open setting with other fellow friends, hard to notice the inattentive and impulsive behavior.

Subject #2:

- Pre-assessment: Child does what he likes to do. Teasing is a method of connecting with people with eating disorders. The smell and taste sensations are intense — this is a problem with eating something new.
- Post assessment: We noticed a shift around a week back; since then, he has been calmer, more patient, cooperating, and showing more interest in Yoga than ever before.

Subject #3:

- Pre-assessment: Parent must push a lot to get something done. Child do not like group activities. Child is well behaved outside and takes liberty with parents — has resistance to doing something new.
- Post assessment: Doesn't like fast food like pizza, intake of it has drastically decreased. Tries to push back when parents, especially mom, expects to complete tasks on time.

Subject #4:

- Pre-assessment: Child is highly inattentive and hyperactive. Could not be in one place for more than a few seconds. Kept moving around the entire time of the class. He tries to mimic and follow 2.5-year-old brother.
- Post assessment: Likes routine activities. He does not like activities that require concentration. Yoga seems to make him calmer.

Subject #5:

- Pre-assessment: Child attends special class in regular school, tries to mimic and follow sister who is 8-years old.
- Post assessment: Child does it all by himself with minimal support, and after four weeks of activities, parent is surprised by such immense change. Traveled to India during the last week of the study. He was calm while traveling, even though he had a bit of ear pressure.

Subject #6:

- Pre-assessment: Child is non-verbal and uses a device “Accent 1000” for speaking. Can barely make A, U, and M sounds. That's it. Able to follow instructions only when repeated or know what to do and when it is predictable. Attends special needs school.
- Post assessment: The yoga sessions were helpful in terms of increasing his body flexibility. Calmer after yoga sessions. Improvement in motor skills like kicking the ball in the park and balancing activities.

Subject #7:

- Pre-assessment: Child can do small tasks. Big tasks stress the child out. Likes reading five pages vs. twenty pages. Intelligent and quick learner. Child was very inattentive and hyperactive at age 6. Much better now.
- Post assessment: None.

Subject #8:

- Pre-assessment: Child perceives how others feel. She exhibits frustration at losing in games. Impulsive behavior, defiant in some areas. Feels frustrated sometimes. Causes stress internally.
- Post assessment: Parents see some improvement in behavior and calmness at home in the evenings and weekends. They just got a report from a teacher this week that she is less compliant, has more difficulty following directions, loses things more at school, is more withdrawn, and plays by herself more or sits in a corner reading a book. Not sure how to reconcile the discrepancy between observations at home and school.

Discussion

Some of the weakness known in this study are:

- The study duration was 4 weeks which was short for such study. Hence, participants' attendance is a critical factor in the effectiveness of the study.
- A small sample size and absence of control group might have affected the results. Small sample size has risk of lower statistical power and higher margin of error.
- Absence of objective assessment

Below listed participants had incidents during the intervention period and missed a few yoga sessions. These may have an overall effect on post-intervention results.

1. Participant #2 had an undesired incidence during a family trip during the last week of the study, which resulted in the participant's state of mind and behavior with family members (especially parents), which may affect the post-assessment results.
2. Participant #4 had dental surgery due to pain in their teeth during the 4th week of yoga sessions, which resulted in missing some yoga sessions and unrest in the participant's behavior at home during this period, which may affect the post-assessment results.
3. Participant #5 traveled to India during the last week of the study and missed a few sessions.
4. Participant #8 fell sick and missed a few yoga sessions during the 4th week of the yoga sessions, which may affect the post-assessment results.

Some of the strengths of the Study are:

- Broad Ancient and Scientific literature review related to cognitive and behavioral improvement with yoga.
- Due to Small Sample Size, was able to give individual attention to participants and able to understand better participants behavior subjectively.
- Due to demography of the participants and mix of in-person and online yoga sessions conducted, able to experiment and compare the effect of in-person and online/virtual sessions. Statistical results show Virtual sessions were as effective as in-person yoga sessions.

Conclusion

In conclusion, the study results are statistically significant compared to previous studies done demonstrating that yoga practice can be utilized as an alternative option for children with ADHD to reduce inattentive, hyperactive behavior and an overall reduction in combined ADHD symptoms in children.

Based on the outcome of this study, a comprehensive research study including Intervention and control groups can be taken up later as an institutional yoga research project.

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Thanks to my wonderful VaYU Cohorts and peers for their continued support and encouragement throughout the course.

With love to my wonderful family for their encouragement, unwavering belief in me and supporting in completing the course.

Appendix

A. NICHQ Vanderbilt ADD/ADHD assessment questionnaire

NICHQ Vanderbilt Assessment Scale—PARENT Informant

Today's Date: _____ Child's Name: _____ Date of Birth: _____

Parent's Name: _____ Parent's Phone Number: _____

Directions: Each rating should be considered in the context of what is appropriate for the age of your child. When completing this form, please think about your child's behaviors in the past 6 months.

Is this evaluation based on a time when the child ☐ was on medication ☐ was not on medication ☐ not sure?

Symptoms	Never	Occasionally	Often	Very Often
1. Does not pay attention to details or makes careless mistakes with, for example, homework	0	1	2	3
2. Has difficulty keeping attention to what needs to be done	0	1	2	3
3. Does not seem to listen when spoken to directly	0	1	2	3
4. Does not follow through when given directions and fails to finish activities (not due to refusal or failure to understand)	0	1	2	3
5. Has difficulty organizing tasks and activities	0	1	2	3
6. Avoids, dislikes, or does not want to start tasks that require ongoing mental effort	0	1	2	3
7. Loses things necessary for tasks or activities (toys, assignments, pencils, or books)	0	1	2	3
8. Is easily distracted by noises or other stimuli	0	1	2	3
9. Is forgetful in daily activities	0	1	2	3
10. Fidgets with hands or feet or squirms in seat	0	1	2	3
11. Leaves seat when remaining seated is expected	0	1	2	3
12. Runs about or climbs too much when remaining seated is expected	0	1	2	3
13. Has difficulty playing or beginning quiet play activities	0	1	2	3
14. Is "on the go" or often acts as if "driven by a motor"	0	1	2	3
15. Talks too much	0	1	2	3
16. Blurts out answers before questions have been completed	0	1	2	3
17. Has difficulty waiting his or her turn	0	1	2	3
18. Interrupts or intrudes in on others' conversations and/or activities	0	1	2	3
19. Argues with adults	0	1	2	3
20. Loses temper	0	1	2	3
21. Actively defies or refuses to go along with adults' requests or rules	0	1	2	3
22. Deliberately annoys people	0	1	2	3
23. Blames others for his or her mistakes or misbehaviors	0	1	2	3
24. Is touchy or easily annoyed by others	0	1	2	3
25. Is angry or resentful	0	1	2	3
26. Is spiteful and wants to get even	0	1	2	3
27. Bullies, threatens, or intimidates others	0	1	2	3
28. Starts physical fights	0	1	2	3
29. Lies to get out of trouble or to avoid obligations (ie, "cons" others)	0	1	2	3
30. Is truant from school (skips school) without permission	0	1	2	3
31. Is physically cruel to people	0	1	2	3
32. Has stolen things that have value	0	1	2	3

Adapted from the Vanderbilt Rating Scales developed by Mark L. Wolraich, MD.

Revised - 1102

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NICHQ National Institute for Children's Health Quality

McNeil Consumer & Specialty Pharmaceuticals

NICHQ Vanderbilt Assessment Scale—PARENT Informant

Today's Date: _____ Child's Name: _____ Date of Birth: _____

Parent's Name: _____ Parent's Phone Number: _____

Symptoms (continued)	Never	Occasionally	Often	Very Often
33. Deliberately destroys others' property	0	1	2	3
34. Has used a weapon that can cause serious harm (bat, knife, brick, gun)	0	1	2	3
35. Is physically cruel to animals	0	1	2	3
36. Has deliberately set fires to cause damage	0	1	2	3
37. Has broken into someone else's home, business, or car	0	1	2	3
38. Has stayed out at night without permission	0	1	2	3
39. Has run away from home overnight	0	1	2	3
40. Has forced someone into sexual activity	0	1	2	3
41. Is fearful, anxious, or worried	0	1	2	3
42. Is afraid to try new things for fear of making mistakes	0	1	2	3
43. Feels worthless or inferior	0	1	2	3
44. Blames self for problems, feels guilty	0	1	2	3
45. Feels lonely, unwanted, or unloved; complains that "no one loves him or her"	0	1	2	3
46. Is sad, unhappy, or depressed	0	1	2	3
47. Is self-conscious or easily embarrassed	0	1	2	3

Performance	Excellent	Above Average	Average	Somewhat of a Problem	Problematic
48. Overall school performance	1	2	3	4	5
49. Reading	1	2	3	4	5
50. Writing	1	2	3	4	5
51. Mathematics	1	2	3	4	5
52. Relationship with parents	1	2	3	4	5
53. Relationship with siblings	1	2	3	4	5
54. Relationship with peers	1	2	3	4	5
55. Participation in organized activities (eg, teams)	1	2	3	4	5

Comments:

For Office Use Only

Total number of questions scored 2 or 3 in questions 1–9: _____

Total number of questions scored 2 or 3 in questions 10–18: _____

Total Symptom Score for questions 1–18: _____

Total number of questions scored 2 or 3 in questions 19–26: _____

Total number of questions scored 2 or 3 in questions 27–40: _____

Total number of questions scored 2 or 3 in questions 41–47: _____

Total number of questions scored 4 or 5 in questions 48–55: _____

Average Performance Score: _____

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D5 NICHQ Vanderbilt Assessment Follow-up—PARENT Informant

Today's Date: _____ Child's Name: _____ Date of Birth: _____

Parent's Name: _____ Parent's Phone Number: _____

Directions: **Each rating should be considered in the context of what is appropriate for the age of your child. Please think about your child's behaviors since the last assessment scale was filled out when rating his/her behaviors.**

Is this evaluation based on a time when the child ☐ **was on medication** ☐ **was not on medication** ☐ **not sure?**

Symptoms	Never	Occasionally	Often	Very Often
1. Does not pay attention to details or makes careless mistakes with, for example, homework	0	1	2	3
2. Has difficulty keeping attention to what needs to be done	0	1	2	3
3. Does not seem to listen when spoken to directly	0	1	2	3
4. Does not follow through when given directions and fails to finish activities (not due to refusal or failure to understand)	0	1	2	3
5. Has difficulty organizing tasks and activities	0	1	2	3
6. Avoids, dislikes, or does not want to start tasks that require ongoing mental effort	0	1	2	3
7. Loses things necessary for tasks or activities (toys, assignments, pencils, or books)	0	1	2	3
8. Is easily distracted by noises or other stimuli	0	1	2	3
9. Is forgetful in daily activities	0	1	2	3
10. Fidgets with hands or feet or squirms in seat	0	1	2	3
11. Leaves seat when remaining seated is expected	0	1	2	3
12. Runs about or climbs too much when remaining seated is expected	0	1	2	3
13. Has difficulty playing or beginning quiet play activities	0	1	2	3
14. Is "on the go" or often acts as if "driven by a motor"	0	1	2	3
15. Talks too much	0	1	2	3
16. Blurts out answers before questions have been completed	0	1	2	3
17. Has difficulty waiting his or her turn	0	1	2	3
18. Interrupts or intrudes in on others' conversations and/or activities	0	1	2	3

Performance	Excellent	Above Average	Average	Somewhat of a Problem	Problematic
19. Overall school performance	1	2	3	4	5
20. Reading	1	2	3	4	5
21. Writing	1	2	3	4	5
22. Mathematics	1	2	3	4	5
23. Relationship with parents	1	2	3	4	5
24. Relationship with siblings	1	2	3	4	5
25. Relationship with peers	1	2	3	4	5
26. Participation in organized activities (eg, teams)	1	2	3	4	5

Adapted from the Vanderbilt Rating Scales developed by Mark L. Wolraich, MD.

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HE0352

B. Pre- and Post-assessment results

Participant #	**#1**		**#2**		**#3**		**#4**		**#5**		**#6**		**#7**		**#8**	
Vanderbilt ADHD assessment Question (NICHQ Vanderbilt, 2002).	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
"1. Does not pay attention to details or makes careless mistakes with, for example, homework"	3	2	3	2	2	1	2	3	2	1	2	1	2	1	2	1
"2. Has difficulty keeping attention to what needs to be done"	3	2	2	2	2	1	3	2	2	2	2	2	2	1	2	2
"3. Does not seem to listen when spoken to directly"	2	3	1	**1**	1	1	1	2	3	2	1	1	2	1	2	2
"4. Does not follow through when given directions and fails to finish activities (not due to refusal or failure to understand)"	3	2	2	2	0	1	2	2	2	1	2	2	2	1	2	1
"5. Has difficulty organizing tasks and activities."	3	2	3	2	1	1	1	2	2	1	2	2	2	1	2	2
"6. Avoids, dislikes, or does not want to start tasks that require ongoing mental effort"	3	2	3	2	1	2	3	3	1	2	2	2	2	1	1	1
"7. Loses things necessary for tasks or activities (toys, assignments, pencils, or books)"	3	2	3	2	0	1	1	2	1	1	0	0	2	1	2	2
"8. Is easily distracted by noises or other stimuli"	3	3	3	3	0	1	3	2	2	1	2	1	2	1	1	1
"9. Is forgetful in daily activities"	3	2	3	2	0	1	0	1	2	1	1	0	2	1	1	1
"10. Fidgets with hands or feet or squirms in seat"	2	3	3	3	1	1	3	2	2	2	2	1	2	1	0	0
"11. Leaves seat when remaining seated is expected"	1	2	3	2	1	0	2	2	2	2	2	2	2	1	0	0
"12. Runs about or climbs too much when remaining seated is expected"	1	2	3	2	1	1	2	2	3	2	2	0	1	1	0	0
"13. Has difficulty playing or beginning quiet play activities"	3	3	3	3	1	1	3	2	2	2	2	2	1	1	0	0
"14. Is "on the go" or often acts as if "driven by a motor"	2	2	3	2	0	1	2	2	2	2	2	1	2	1	0	0
"15. Talks too much"	3	2	3	2	0	0	0	0	1	0	0	0	2	1	0	0
"16. Blurts out answers before questions have been completed"	3	2	3	2	0	0	0	0	1	0	1	0	2	1	1	1
"17. Has difficulty waiting his or her turn"	3	2	3	2	0	0	2	2	2	2	2	2	2	1	1	1
"18. Interrupts or intrudes in on others' conversations and/or activities"	3	3	3	3	0	0	1	0	1	1	2	2	2	1	2	1

C. Yoga session attendance log

Yoga session attendance											
Participant #	**2/12**	**2/13**	**2/16-17**	**2/19**	**2/20**	**2/23-24**	**2/26**	**2/27**	**3/2-3**	**3/5**	**3/6**
1	no	yes	yes	no	yes	no	yes	yes	no	yes	yes
2	yes	yes	yes	yes*	no	yes	yes	yes	yes	yes	yes
3	yes	yes	yes	yes	yes	yes*	yes	yes	yes*	yes	yes
4	yes	yes	yes	yes	no	yes	yes	no	no	no	yes
5	yes	yes	yes	yes	yes	yes	yes	no	yes	no	no
6	yes	yes	yes	yes	yes	yes	yes	yes	no	yes*	yes*
7	yes	yes	no	yes	yes	yes*	yes	yes	no	yes	yes
8	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes

* Virtual class over zoom