Section A -Research paper

Efficacy for Newly Integrated Yoga-based Intervention for Treating Learning Disabilities and Attention-Deficit Hyperactivity Disorder (ADHD): A Randomized Pilot Study

Ravi A[1],PonnulakshmiR[1]*Ananthi D[2], Rajathi Sakthivel[3]

[1]Central Research Laboratory, Meenakshi Ammal Dental College and Hospital, Chennai and Meenakshi Academy of Higher Education and Research, Deemed to be University, Chennai, Tamil Nadu

[2]College of Nursing, Madras Medical College, Chennai, Tamil Nadu

[3]Department of Pediatrics, Hindu Mission College of Nursing, Chennai

Corresponding Author*

Dr. Ponnulakshmi, R

Scientist Grade-III

Central Research Laboratory

Meenakshi Ammal Dental College and Hospital

Chennai and Meenakshi Academy of Higher Education and Research

Deemed to be University, Chennai, Tamil Nadu

Email: drponnulakshmi.researchscientist@madch.edu.in

DOI:10.48047/ecb/2023.12.si4.697

Abstract

Background: Physical activity based Yoga-practices along with Training Activities for learning problems has been identified as a promising intervention to improve Attention Deficit Hyperactivity Disorder (ADHD) with Learning Difficulties (LD).

Objective: The purpose of this study is aimed to examine the efficacy of a newly developed Yoga-based Intervention with Multiple Training Activities for children with ADHD and LD in schools from Chengalpattu, Tamil Nadu.

Methods: This is a single-group pretest-posttest study utilized with randomization. The Checklist for Teachers was used as a preliminary screening tool to assess ADHD and LD and the teachers evaluated 327 children in studying grades 2 to 7 for early screening. Within that 33 children were randomly selected based on the preliminary screening and piloted for this study. The Colorado Learning Disabilities Questionnaire (CLDQ; Willcutt, Boada, Riddle, Chhabildas, DeFries& Pennington, 2011) and the Conner's Teacher Rating Scale-Revised

[1]Scientist-III, Central Research Laboratory, Meenakshi Ammal Dental College and Hospital, Chennai and Meenakshi Academy of Higher Education and Research, Deemed to be University, Chennai, Tamil Nadu

[2]Assistant Professor, College of Nursing, Madras Medical College, Chennai, Tamil Nadu

[3]Head and Vice Principal, Department of Pediatrics, Hindu Mission College of Nursing, Chennai

(CTRS-R; Conners et al., 1998) were utilized in the main study, including pretest and posttest.

Results: The results revealed that there is no significant gender difference on subscales of Inattention, Hyperactivity, Impulsivity, Psychological issues, Peer issues, and Personality issues score on the baseline measure of CTRS-R. However, the Academic issues subscale score differed based on gender ($t=2.32$, $p=0.02$). There is no significant difference based on the medium of instruction, order of birth, parent education, and school type in all the subscales of CTRS-R. On comparing to the pretest-posttest of CTRS-R score, it was found that the newly developed integrated intervention program significantly reduced the symptoms of Hyperactivity, Peer issues, Personality issues, and academic issues, as well as reduced LD symptoms.

Conclusion: This newly developed Yoga-Based Integrated Multi Training Intervention significantly helped to reduce ADHD symptoms and enhance academic-based performance in their school activities and mingle with peer groups positively. These findings provide preliminary support to the newly developed Intervention module for children with ADHD and LD. However, further study may be warranted to evidence the result gained from this study.

Keywords:*Yoga-Based Integrated Intervention, ADHD, Children, Learning Disabilities.*

Introduction

Attention Deficit Hyperactivity Disorder(ADHD) is characterized by formatively improper levels of inattention, over-activity, distractibility, and impulsiveness, which show during childhood(Kuppili et al., 2017; Melby-Lervåg & Hulme, 2013). Research recommends that failures in inhibitory control may represent the core cognitive deficit underlying the sign of ADHD. Particularly, a developing body of research has recommended that ADHD-related deficits in inhibitory control are related with failures within the cascade of processes underlying the stimulus–response relationship, including decreases in the allotment of attentional resources, delays within the speed at which stimuli are processed, and failures to fittingly actualize activity checking forms as evaluated utilizing neuro-electric measures(Jones et al., 2016; Karim & Venkatachalam, 2018, 2020; Peijnenborgh et al., 2016). In spite of the fact that pharmacologic treatments have largely proven effective in managing ADHD symptoms, potential antagonistic impacts, high costs, and inadequate responses argue for other nonpharmacological treatments for children with ADHD. In Indian context, Learning disorder (also known as Learning Difficulties)constitutes difficulties that may arise due to significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or Mathematical abilities(Rousseeuw, 1987; Wu et al., 2014). Studies stated that Academic and non-academic characteristics are highly associated with learning disorders, including characteristics related to reading, mathematics, written expression, expressive and receptive language, cognition (Attention, Memory, and Metacognition), and social/emotional areas(Geary, 2013; Pascoe et al., 2020).These children have a history of repeated failures, low self-concept and problems with peer relationships. However, very rare study only found in the combination of ADHD and LD, specifically in the Indian context.

A promising but methodologically frail literature particular to ADHD and physical activity has risen in recent years overwhelmed by single group and non-randomized trials of regular physical activity. This literature gives preparatory evidence of a temporal impact of acute physical activity on cognition, and associations between regular physical activity and cognition in children with ADHD(Chou & Huang, 2017; Deng, 2017; Torgesen, 2004). Outstandingly, indeed results from non-randomized trials are dubious, rigorous randomized controlled trials are essential to set up causal impacts of regular physical activity on ADHD outcomes.Particularly, Yoga-practices are a system of psycho-physical training that has its goal the uncovering of mystical consciousness. Studies evidenced that Yoga-based practices(techniques of meditation, Asanas, and pranayama) provides positive effects on not only in the management of stress, anxiety, emotion but also helped to improve eye-hand coordination, attention, concentration, and relaxation among school children(Cohen et al., 2018; Evans et al., 2018; Hariprasad et al., 2013; Herbert & Esparham, 2017). The processing of sensory information at the thalamic level is facilitated during the practice of pranayama and meditation. These two practices along with physical postures (Asanas) and cleansing practiceswere focused to bring about an improvement in the steadiness of children through proper practices.

According to Meyer et al. (2004)stated that the physical activities have positive influences and shortly reduced stress, anxiety and depression, produces positive influence on learning disability and improve the academic performance. To examine the existing literature, several studies have been reported positive effect of physical activity among LD students. Some studies noticed that social skill deficits have been remediated and suggesting further for implementing training program and interventional activity for student with learning disabilities. In another study, Brunner et al. (2017)examined the effectiveness of yoga-program to enhance improvement in maintaining working memory of children with learning disabilities. The results also found positive effect and significant improvement was observed in working memory.

Objectives

For the purposes of this study, examine the effectiveness of the integrated yoga-based intervention with multiple training activitieswith ADHD and LD children.The researchers set out to develop and test the efficacy of a yoga-based intervention for improving overall wellbeing of the children, reduce the hyperactivity symptoms, as well as overcoming academic problems.

Hypotheses

The researcher tested the following hypotheses to obtain the above objective of the study:

Hypothesis 1: There is no significant demographic differences (gender, medium of instruction, studying grade, order of birth, and type of school)on improving children with learning and ADHD problem based on post-test outcome scores.

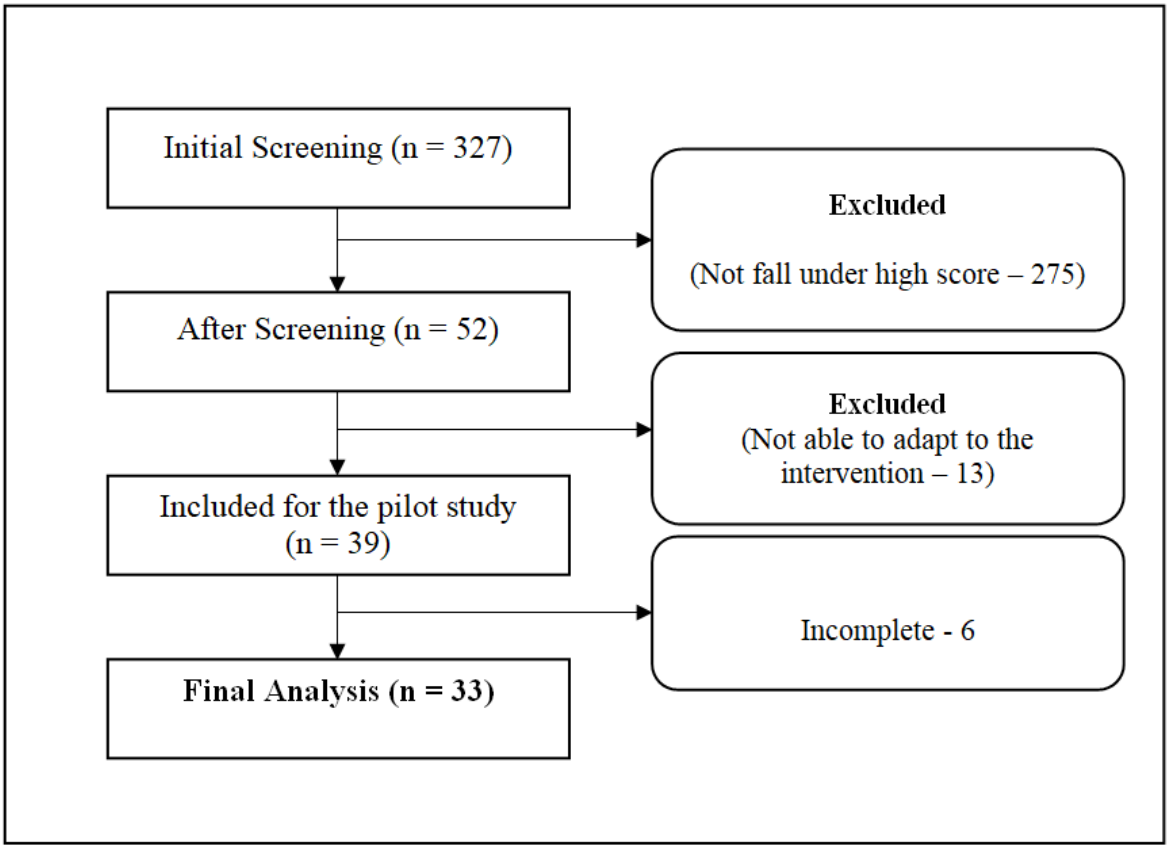
Hypothesis 2: The mean post-test scores of children with learning difficulties will be significantly lower than their pre-test scores on CTRS subscales that reflects significant effect on implementing yoga-based intervention with children.

Methods

Totally, 327 children were evaluated by teachers for selecting the children with ADHD and LD and studying in normal schools under grade two to seven in Chengalpattu, Tamil Nadu. The flow chart was shown the complete the selection process of the sample for the study (Figure 1). The study was based on a single group pretest and post-test design with a randomized sampling method.

The Colorado Learning Disabilities Questionnaire (CLDQ; Willcutt et al., 2011)and the Conner's Teacher Rating Scale-Revised (CTRS-R; Conners et al., 1998)were utilized in the main study, including pretest and posttest to exclude the children. The exclusion criteria were the presence of ADHD, LD and academic oriented problems with children. After applying the exclusion and inclusion criteria, 39 participants were selected to conduct thispilot study. Meanwhile, six participants were not completely done the intervention and hence excluded from the final analysis of this study.

Figure 1. A flow chart demonstrating the participants screening and final selection.



Yoga-Based Intervention Integrated with Multiple Training Activities

Psychologically, yoga shows ways of understanding the functioning of the mind and helps to quite their movements which leading towards the undisturbed state of silence that dwells in the seat of consciousness(Chou & Huang, 2017; Cohen et al., 2018; Evans et al., 2018). This yoga-based intervention included Asanas and pranayama which is also called as yoga-breathing refers to a life of discipline and learning. In this yoga practices incorporates four broad categories such as warm-up poses, strengthening poses, releases of tension poses, and calming poses. Within each category, several poses integrated within the intervention.

For improving academic based learning difficulties symptoms like writing backward of letters, skipping sentences while reading, and writing mirror reflection based numbers, activities are integrated with this yoga-based intervention.

Tools used for the study

A set of teachers-based assessment was used to assess ADHD and LD for each participant at the study entry and post-intervention of the study. All the assessments were carried out by the primary author and evaluated by class teacher who was scored each participants based on their observation and assess the neuropsychological assessments. The primary outcome was measured using the Colorado Learning Disabilities Questionnaire (CLDQ)used to measure learning difficulties, followed by Conner's Teacher Rating Scale-Revised (CTRS-R)was used to measure the ADHD and subdomains. The CTRS consists of inattention, hyperactivity, impulsivity, psychological issues, peer issues, personality issues, and academic issues. More score tend to be higher in specific subdomain.

Ethical Consideration

The study protocol was granted a favourable ethical opinion (Ref. No: 89/MAHERPhD/IEC/FEB2021) from the Institutional Ethics Committee (IEC), Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu.

Statistical analysis

The results were analysed by using Jamovi Software, which is incorporated with R Programming package. The paired-t test method was used to assess the significant differences in their pre and post-test scores. Also, group comparisonswere carried out based on certain demographic characteristics.

Results

Participant's characteristics

Table I and II shown the characteristics of study participants. Out of 33 participants, 16 were male (48.49%) and 17 were female (51.51). Over half of the participants were studying in English medium (60.60%) and nearly half of the children studying between the 6^{th} and 7^{th} grade (42.42%). Further, only 4 participants were born on third child in the order of their birth (12.12%). Based on parent education, 15 participants parents were educated and come under graduate and more category (45.45%), whereas, 7 participants'parents were illiterate (21.22%).

Table I: Participants characteristics

	n	**%**
Gender		
Male	16	48.49
Female	17	51.51
Medium of Instruction		
English	20	60.60
Tamil	13	39.40
Grade Studying		
2-3^{rd} grade	12	36.36
4^{th} – 5^{th} grade	7	21.22
6^{th} – 7^{th} grade	14	42.42

Parent education		
Illiterate	7	21.22
Up to 10th grade	6	18.18
11th and 12th grade	5	15.15
Graduate and more	15	45.45
Order of Birth		
First	12	36.37
Second	8	24.24
Third or last	4	12.12
Only child	9	27.27
Type of school		
Govt	18	54.55
Private	15	45.45

The descriptive characteristics of CTRS-R was shown in Table II and the normality curve was shown in Figure II and III. These table and figures showed that the sample is clearly normally distributed and hence parametric tests were executed for further analysis. Further, Table II shows that participants' mean scores, standard deviation, skewness and kurtosis on both pre-test and post-test of CTRS-R were used during screenings. The mean pre-test scores of inattention subdomain of CTRS-R score was 19.90 (SD=3.07), followed by hyperactivity was 19.20 (SD=2.18), impulsivity was 5.94 (SD=1.39), psychological issues was 22.90 (SD=4.52), peer issues was 6.79 (SD=1.67), personality issues (31.60; SD=4.81), and academic issues (18.60; SD=4.13), respectively.Similarly, the mean post-test scores of inattention was 19.0 (SD=2.70), followed by hyperactivity (16.50; SD=2.28), impulsivity (5.55; SD=1.30), psychological issues (23.60; SD=4.29), peer issues (5.76; SD=1.20), personality issues (28.20; SD=3.82), and academic issues (16.30; SD=4.00).

Table II: Descriptive characteristics of CTRS-R

	n	**Pre-test**				**Post-test**			
		X	**SD**	**[X]**	**k**	**X**	**SD**	**[X]**	**k**
CTRS-R									
Inattention		19.90	3.07	0.32	-0.45	19.00	2.70	0.33	0.00
Hyperactivity		19.20	2.18	-0.23	-0.09	16.50	2.28	-0.33	-0.09
Impulsivity		5.94	1.39	-0.03	-0.28	5.55	1.30	-0.15	-0.48
Psychological Issues	33	22.90	4.52	0.42	0.65	23.60	4.29	0.34	-0.69
Peer Issues		6.79	1.67	-0.15	-0.76	5.76	1.20	-0.19	-0.28
Personality Issues		31.60	4.81	0.65	-0.28	28.20	3.82	0.80	1.68
Academic Issues		18.60	4.13	-0.03	-1.15	16.30	4.00	-0.12	-1.47

Note:*n*-number of participants; X-Mean; SD-Standard deviation; [X]-Skewness; k-Kurtosis

While comparing demographic characteristics between the groups, gender-based group, except academic issues of CTRS-R subdomain ($t=2.32$, $p<0.05$), all the other sub-domains were not found any significant difference based on gender. Also, other demographic based independent groups such as medium of instruction and grade studying was not found

any significant difference in both pre-test as well as post-test. Based on order of birth, psychological issues were differed based on order of birth, specifically, in pre-test CTRS-R score of psychological issues ($F=5.29$, $p<0.05$). Furthermore, there is no significant difference between the types of schools (Government Vs Private) in all the subdomains of CTRS-R.

Figure II: Normality curve of each subdomains of CTRS-R on Pre-test

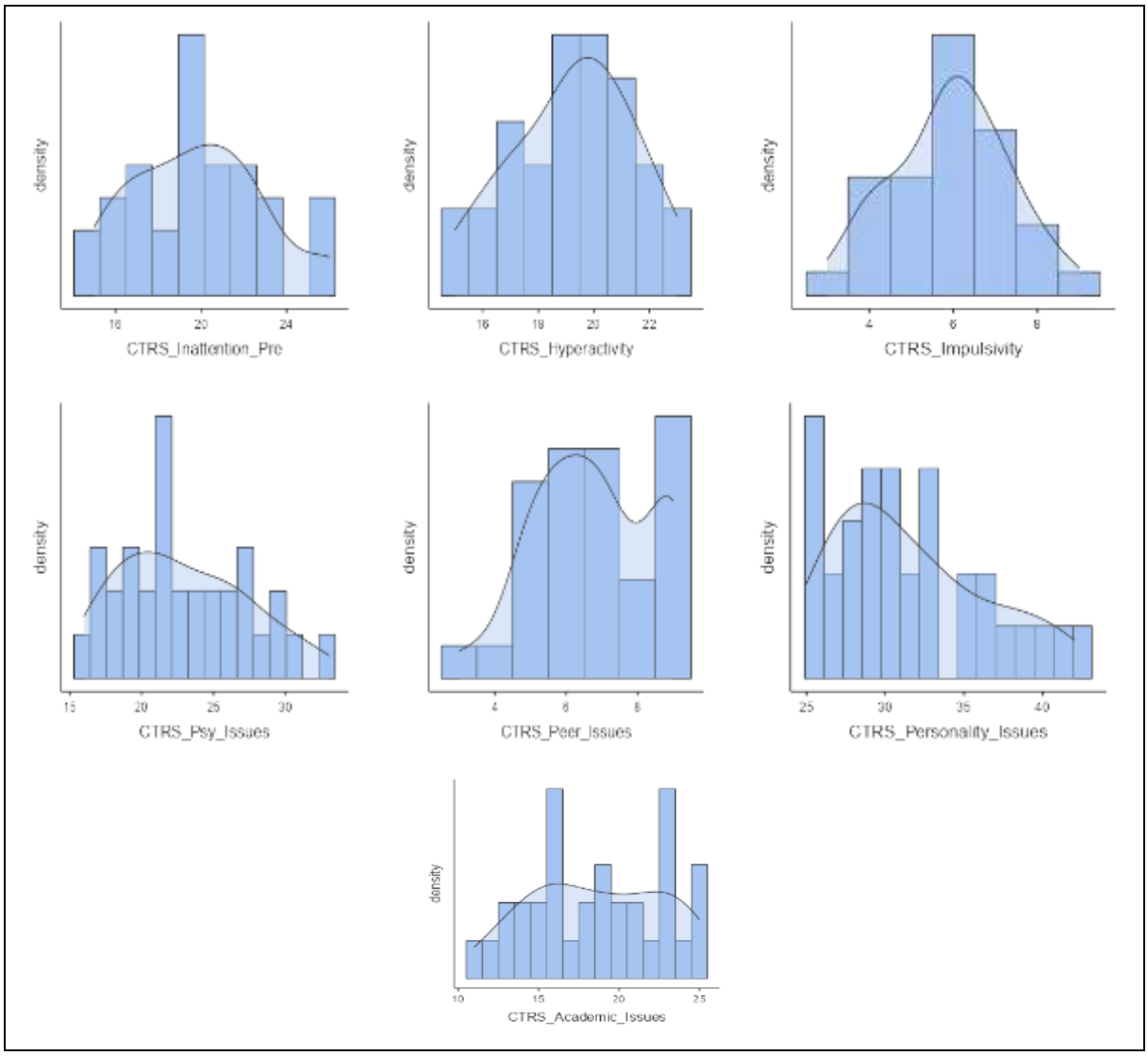


Table III: Comparison of pre-test and post-test scores of CTRS-R

Pre-test	Post-test						95% Confidence Interval	
		t	df	p		Effect	Lower	Upper
Inattention	Inattention	1.46	32.0	0.15	Cohen's d	0.25	-0.09	0.60
Hyperactivity	Hyperactivity	8.82	32.0	< .01	Cohen's d	1.53	1.02	2.03
Impulsivity	Impulsivity	1.25	32.0	0.21	Cohen's d	0.21	-0.12	0.56

Psy_Issues	Psy_Issues	-0.90	32.0	0.37	Cohen's d	-0.15	-0.49	0.18
Peer_Issues	Peer_Issues	3.72	32.0	< .01	Cohen's d	0.64	0.26	1.02
Personality_Issues	Personality_Issues	7.24	32.0	< .01	Cohen's d	1.26	0.79	1.71
Academic_Issues	Academic_Issues	8.11	32.0	< .01	Cohen's d	1.41	0.92	1.89

Figure II: Normality curve of each subdomains of CTRS-R on Pre-test

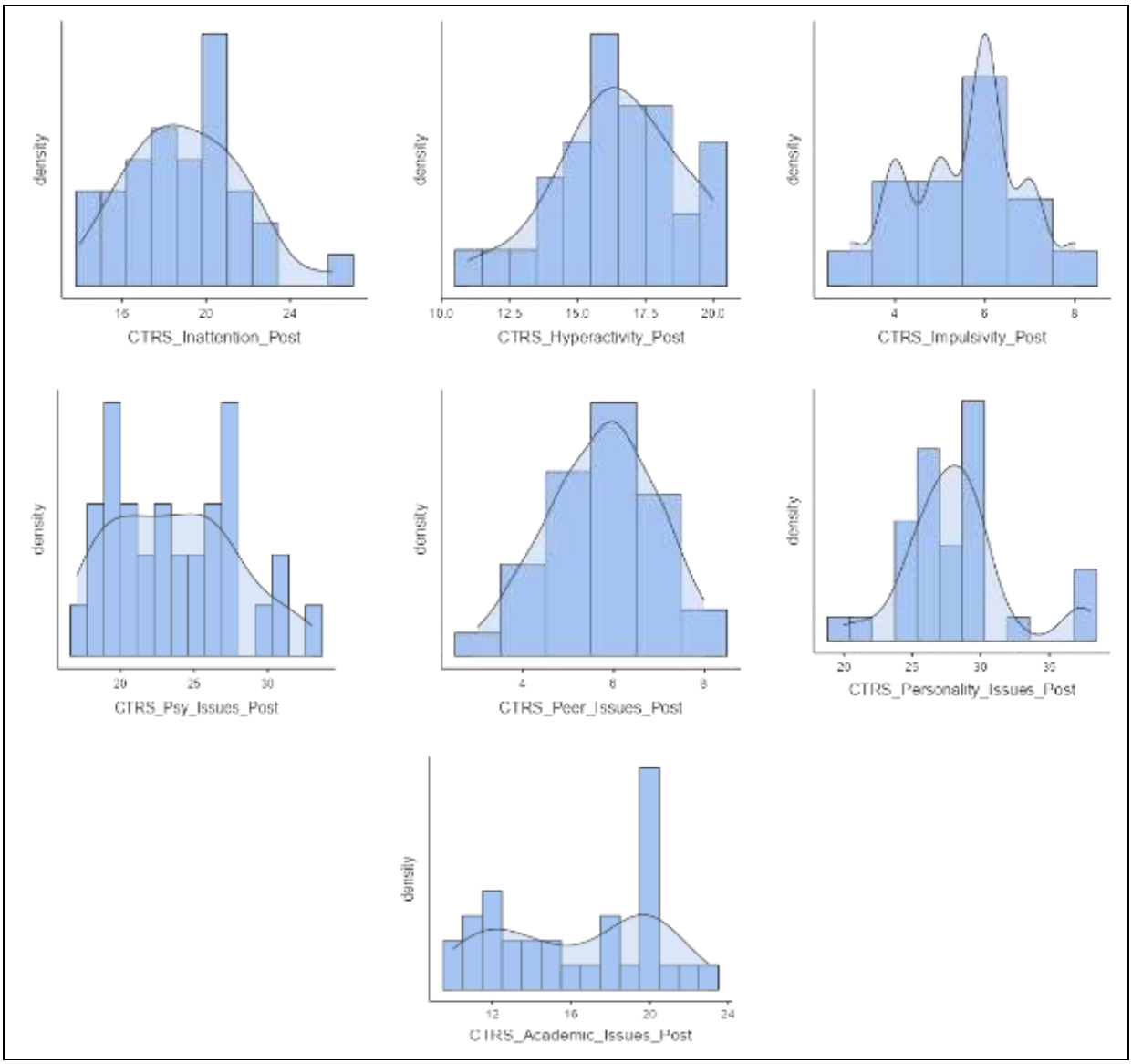


Table IV: Comparison of pre-test and post-test scores of CLDQ

Pre-test	Post-test						95% Confidence Interval	
		t	df	p		Effect	Lower	Upper
LD	LD	4.05	32.0	0.01	Cohen's d	0.70	0.32	1.08

Table III and IV shows that paired t-test analysis of pretest and posttest scores of CTRS-R and CLDQ, specifically subdomains of CTRS-R, which undergone to know the

effect of Integrated Yoga-based Intervention. Through the analysis, it was found that the newly developed Intervention program significantly reduce the ADHD symptoms, particularly subdomains of Hyperactivity (t=8.82, p=0.01), Peer Issues (t=3.72, p=0.01), Personality Issues (t=7.24, p=0.01), and Academic Issues (t=8.11, p=0.01). However, there is no significant difference between pre and post-test on Inattention (t=1.46, p=0.15), Impulsivity (t=1.25, p=0.21), and Psychological issues (t=-0.90, p=0.37) domains of CTRS-R. The effect size is higher in Hyperactivity, followed by Academic and personality changes. Furthermore, significant difference also found in pre and post-test scores of CLDQ (t=4.05, p=0.01). It showed that the CLDQ score decreased as compare to the baseline score (53.20 ± 8.27 vs. 50.20 ± 8.43).

Discussion

The main results of this present study is the primary outcomes (CTRS-R and CLDQ), support a moderate efficacy of the newly developed yoga-based intervention with multiple training activities related to academic improvement was administered to reduce the subjective ADHD and LD related symptoms associated with children who studying in Chennai, Tamil Nadu. The CTRS-R score reduced at post-intervention which represents a direct impact on the intervention. Particularly, subdomains of CTRS-R such as Hyperactivity, Peer Issues, Personality Issues, and Academic Issues were deduced and significant changes were noticed with children in the intervention group. However, not such effect was observed in other subdomains such as Inattention, Impulsivity, and Psychological issues. Certain portion of the disparity watched between the results of both scales (CTRS-R and CLDQ) might be clarified by the distinctive features of the children. Focusing on the children who had involved with yoga-based integrated intervention, those more likely to reduce theirhyperactivity and settle down in their emotions and built rapport with peer groups were observed by teachers that was reflected in the post-test scores of CTRS-R and CLDQ. On the other hand, the results were similar with other supporting studies that children with ADHD took more time than children without ADHD to complete rapid movements which reflect in hyperactivity scores of CTRS-R, with more variable speed and accuracy of the arm movements(Chou & Huang, 2017; Kuthalingam et al., 2022; Rezaei et al., 2018). A study suggested that children with ADHD use more on-line corrections when performing accuracy tasks in comparison to their peers without ADHD.The decrease of Hyperactivity score on CTRS-R confirmed that the yoga-based this newly developed integrated intervention help to improve the speed and accuracy of children while involving with certain goals/tasks.

Even though the intervention produced some solid evidence for the effect with children with ADHD and LD symptoms, various hurdles encountered during the implementation of intervention and substantial revision is warranted further for better improvement in various other subdomains of CTRS-R. The effect sizes and certain significant subdomains (In attention, Impulsivity, and Psychological issues of CTRS-R) seen with this intervention were not found any effect and found very minimal effect on this domains, such findings are also contradictory with previous studies(Cohen et al., 2018; Gothe & McAuley, 2015). Hence, improving children with ADHD, Inattention domain is significant and need to enhance its abilities. For that reframing the yoga intervention specifically focused on Inattention based yoga exercises should be incorporated with this intervention is

recommended. Also, while implementing intervention, certain prerequisites are taken into considerations, specifically, problems in adjusting the classroom time-table, lack of sincere and dedicated teachers to evaluate children patiently.Additionally, future study might be needed to examine fundamentally about the practicality of this newly developed Yoga-based integrated intervention program by utilizing the longitudinal study with a controlled trial.

Conclusion

The Yoga-based multi training intervention provide a solid evidence to reduce the ADHD and LD symptoms of the school going children. Overall, this intervention provides preparatory feedback on the possibility and potential suitability of yoga practices intervention when delivered to children with ADHD and learning difficulties. The results of this pilot study suggested promising effect with Hyperactivity, personality and academic related issues with school children. As in the framework, this intervention is feasible and an additional step is needed to confirm the study's findings. In addition, empirical evidences should be considered with a large sample, a times series or randomized study with controlled trials and replication of the study results may also help to demonstrate adequacy of the intervention program.

Conflict of Interest

No

References

Brunner, D., Abramovitch, A., & Etherton, J. (2017). A yoga program for cognitive enhancement. *PLoS ONE*, *12*(8), 4–15. https://doi.org/10.1371/journal.pone.0182366

Chou, C. C., & Huang, C. J. (2017). Effects of an 8-week yoga program on sustained attention and discrimination function in children with attention deficit hyperactivity disorder. *PeerJ*, *2017*(1). https://doi.org/10.7717/peerj.2883

Cohen, S. C. L., Harvey, D. J., Shields, R. H., Shields, G. S., Rashedi, R. N., Tancredi, D. J., Angkustsiri, K., Hansen, R. L., & Schweitzer, J. B. (2018). Effects of Yoga on Attention, Impulsivity, and Hyperactivity in Preschool-Aged Children with Attention-Deficit Hyperactivity Disorder Symptoms. *Journal of Developmental and Behavioral Pediatrics*, *39*(3), 200–209. https://doi.org/10.1097/DBP.0000000000000552

Conners, C. K., Sitarenios, G., Parker, J. D. A., & Epstein, J. N. (1998). Revision and Restandardization of the Conners Teacher Rating Scale (CTRS-R): Factor Structure, Reliability, and Criterion Validity. *Journal of Abnormal Child Psychology*, *26*(4), 279–291.

Deng, B. (2017). Spark Motor Program to develop Psychomotor Skills in learning disorder Chinese students. *NeuroQuantology*, *15*(3), 185–192. https://doi.org/10.14704/nq.2017.15.3.1098

Evans, S., Ling, M., Hill, B., Rinehart, N., Austin, D., & Sciberras, E. (2018). Systematic review of meditation-based interventions for children with ADHD. *European Child and Adolescent Psychiatry*, *27*(1), 9–27. https://doi.org/10.1007/s00787-017-1008-9

Geary, D. C. (2013). Early Foundations for Mathematics Learning and Their Relations to

Learning Disabilities. *Current Directions in Psychological Science*, *22*(1), 23–27. https://doi.org/10.1177/0963721412469398

Gothe, N. P., & McAuley, E. (2015). Yoga and Cognition: A Meta-Analysis of Chronic and Acute Effects. *Psychosomatic Medicine*, *77*(7), 784–797. https://doi.org/10.1097/PSY.0000000000000218

Hariprasad, V. R., Arasappa, R., Varambally, S., Srinath, S., & Gangadhar, B. N. (2013). Feasibility and efficacy of yoga as an add-on intervention in attention deficit-hyperactivity disorder: An exploratory study. *Indian Journal of Psychiatry*, *55*(7). https://doi.org/10.4103/0019-5545.116317

Herbert, A., & Esparham, A. (2017). Mind–body therapy for children with attention-deficit/hyperactivity disorder. *Children*, *4*(5), 1–13. https://doi.org/10.3390/children4050031

Jones, A., Di Lemma, L. C. G., Robinson, E., Christiansen, P., Nolan, S., Tudur-Smith, C., & Field, M. (2016). Inhibitory control training for appetitive behaviour change: A meta-analytic investigation of mechanisms of action and moderators of effectiveness. *Appetite*, *97*, 16–28. https://doi.org/10.1016/j.appet.2015.11.013

Karim, M. A., & Venkatachalam, J. (2018). Computerized Word-Colour Interference among School Children. *The Research Journal of Social Sciences*, *9*(11), 55–59.

Karim, M. A., & Venkatachalam, J. (2020). Cognitive Abilities and Executive functioning of Primary School Children: A Comparative analysis. *Journal of Xidian University*, *14*(7), 769–782. https://doi.org/10.37896/jxu14.7/084

Kuppili, P. P., Manohar, H., Pattanayak, R. D., Sagar, R., Bharadwaj, B., & Kandasamy, P. (2017). ADHD research in India: A narrative review. *Asian Journal of Psychiatry*, *30*(February 2017), 11–25. https://doi.org/10.1016/j.ajp.2017.07.022

Kuthalingam, A. D., Fnu, S., Pitchai, S., Staten, B. H., & Devi, K. A. (2022). Benefits Of School-Based Yoga Intervention for Students with And Without ADHD-Current Findings and Future Implications Benefits Of School-Based Yoga Inte... FNU Shanjuvigasini et al / Benefits Of School-Based Yoga Intervention for Students with And Withou. *NeuroQuantology*, *20*(7), 247–263. https://doi.org/10.14704/nq.2022.20.7.NQ33030

Melby-Lervåg, M., & Hulme, C. (2013). Is working memory training effective? A meta-analytic review. *Developmental Psychology*, *49*(2), 270–291. https://doi.org/10.1037/a0028228

Meyer, K., Niemann, S., & Abel, T. (2004). Gender differences in physical activity and fitness - Association with self-reported health and health-relevant attitudes in a middle-aged Swiss urban population. *Journal of Public Health*, *12*(4), 283–290. https://doi.org/10.1007/s10389-004-0042-5

Pascoe, M. C., Hetrick, S. E., & Parker, A. G. (2020). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth*, *25*(1), 104–112. https://doi.org/10.1080/02673843.2019.1596823

Peijnenborgh, J. C. A. W., Hurks, P. M., Aldenkamp, A. P., Vles, J. S. H., & Hendriksen, J. G. M. (2016). Efficacy of working memory training in children and adolescents with learning disabilities: A review study and meta-analysis. *Neuropsychological*

Rehabilitation, *26*(5–6), 645–672. https://doi.org/10.1080/09602011.2015.1026356

Rezaei, M., Kamarzard, T. S., & Razavi, M. N. (2018). The effects of neurofeedback, Yoga interventions on memory and cognitive activity in children with attention deficit/hyperactivity disorder: A randomized controlled trial. *Annals of Applied Sport Science*, *6*(4), 17–27. https://doi.org/10.29252/aassjournal.6.4.17

Rousseeuw, P. J. (1987). Silhouettes: A graphical aid to the interpretation and validation of cluster analysis. *Journal of Computational and Applied Mathematics*, *20*(C), 53–65. https://doi.org/10.1016/0377-0427(87)90125-7

Torgesen, J. K. (2004). Learning Disabilities. An Historical and Conceptual Overview. *Learning About Learning Disabilities*, 3–40. https://doi.org/10.1016/B978-012762533-1/50004-4

Willcutt, E. G., Boada, R., Riddle, M. W., Chhabildas, N., DeFries, J. C., & Pennington, B. F. (2011). Colorado Learning Difficulties Questionnaire: Validation of a Parent-Report Screening Measure. *Psychological Assessment*, *23*(3), 778–791. https://doi.org/10.1037/a0023290

Wu, C. Da, McNeely, E., Cedeño-Laurent, J. G., Pan, W. C., Adamkiewicz, G., Dominici, F., Lung, S. C. C., Su, H. J., & Spengler, J. D. (2014). Linking student performance in Massachusetts elementary schools with the "greenness" of school surroundings using remote sensing. *PLoS ONE*, *9*(10), 1–9. https://doi.org/10.1371/journal.pone.0108548