Original Article

Sensory Integration for ADHD in Schools

Effectiveness of School-Based Sensory Integration Therapy in Addressing Emotional and Behavioral Challenges in Children with ADHD Symptoms

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ABSTRACT

Objective: To assess the efficacy of school-based Sensory Integration Therapy in improving emotional and behavioral problems in children with ADHD symptoms.

Study Design: A pilot randomized controlled trial study.

Place and Duration of Study: This study was conducted at the Department of Child and Adolescent Psychiatry, Faculty of Medicine, Airlangga University, Dr. Soetomo General Academic Hospital, Jl. Mayjen. Prof. Dr. Moestopo, 47, Surabaya, Jawa Timur, 60286, Indonesia from July 2023 to March 2024.

Methods: A pilot randomized controlled trial was conducted using a total sampling technique with a non-blinded, pre-posttest control group design. The Abbreviated Conners' Teacher Rating Scale (ACTRS) was used for screening, and the parent-reported Strengths and Difficulties Questionnaire (SDQ) measured emotional and behavioral problems before and after biweekly Sensory Integration Therapy over four weeks.

Results: Fourteen children identified with ADHD symptoms were randomly assigned to either the intervention or control group through drawing lots. A significant improvement ($p < 0.05$) was observed in SDQ scores in the intervention group after therapy compared to their baseline and the control group.

Conclusion: School-based Sensory Integration Therapy significantly improves emotional and behavioral problems in children with ADHD symptoms

Key Words: ADHD, emotion, behavioral problem, mental well-being, sensory integration therapy, school-based therapy

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INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder characterized by inattention, hyperactivity, and impulsivity. ADHD symptoms fluctuate throughout development, sometimes meeting diagnostic criteria and other times falling below the threshold.[1]

Sensory impairments, often referred to as Sensory Processing Disorder (SPD), are prevalent in ADHD and affect emotional regulation and behavior, impacting daily functioning, mental well-being, social interactions, and increasing the risk of comorbid mental disorders.[2–3]

Global ADHD prevalence ranges from 4% to 11.4%,[4,5] with rates in Indonesia varying from 3% to 26.2%.[6,7] Subclinical ADHD symptoms affect 0.8%–23.1% of children and adolescents globally.[8,9] Emotional dysregulation is found in 25%–45% of children with ADHD, with high rates of depression (45%–55%) and bipolar disorder (21%), further reducing quality of life.[10,11] ADHD symptoms often interfere with academic performance, leading to frequent referrals to psychology and psychiatry clinics.[5,12] Emotional and behavioral problems are common, but parental concerns about medication side effects highlight the need for non-pharmacological interventions that address sensory and emotional regulation.[12-14]

Sensory Integration Therapy, originally developed for autism spectrum disorder (ASD), has been shown to improve irritability, behavior, and social functioning. It also enhances sensory and emotional processing, addressing ADHD symptoms while supporting adaptability and mental health.[15] School-based interventions are effective in promoting mental health

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and managing ADHD-related academic and behavioral challenges.[16] This pilot study evaluates the efficacy of school-based Sensory Integration Therapy in improving emotional regulation and behavior in children with ADHD symptoms in Indonesia.

METHODS

This study was a pilot randomized controlled trial with a pre-posttest control group design and non-blinded setup, conducted in an elementary school in Surabaya, Indonesia, where children are regularly evaluated for learning disorders such as concentration problems and hyperactivity. A total sampling technique was employed, including all children who met the inclusion criteria, with ethical clearance obtained from the Institutional Review Board (183/EC/KEPK/ FKUA/2023). Consent for participation was secured from the school principal, teachers, parents, and children before screening. The Abbreviated Conners' Teacher Rating Scale (ACTRS), a school-based ADHD screening tool with 90% sensitivity, was used, consisting of 10 Likert-scale questions completed by teachers based on observations over the preceding six months. The intervention group received school-based Sensory Integration Therapy twice weekly for four weeks, while the control group was monitored without intervention. Of the 120 children screened, 14 met the inclusion criteria. Parents of all participants completed the Strengths and Difficulties Questionnaire (SDQ), a 25-item Likert-scale tool assessing emotional, behavioral, and relationship problems over the past six months, administered before and after the intervention. Participants were randomly assigned to either the intervention or control group using a lottery system. The primary outcome measure was the improvement in emotional and behavioral problems as assessed by the SDQ. Data were analyzed using SPSS version 24, employing McNemar, Shapiro-Wilk, paired t-tests, Wilcoxon, independent t-tests, and Mann-Whitney tests, with a multidisciplinary research team overseeing the study.

RESULTS

Participant Characteristics: Out of 120 children screened, 14 met the inclusion criteria and agreed to participate after informed consent. Parents completed the Strengths and Difficulties Questionnaire (SDQ) before and after the intervention. No participants dropped out. The majority (92.9%) were 10 years old, with one child (7.1%) aged 9. All control group participants were 10 years old, while the treatment group included six 10-year-olds (85.7%) and one 9-year-old (14.3%). Most participants were male (71.4%, n=10), with four females (28.6%). The control group was entirely male (100%, n=7), whereas the treatment group had three males (42.9%) and four females (57.1%).

Emotional and Behavioral Outcomes Before and After Sensory Integration Therapy: In the control group, SDQ scores remained unchanged, with all participants staying in the abnormal category. In contrast, the treatment group showed improvements, with participants transitioning to normal categories in emotional problems (83.3%), behavioral problems (66.7%), hyperactivity-inattention (66.7%), peer problems (25%), and total difficulties (60%). However, no significant differences ($p \geq 0.05$) were found in either group's pre- and post-intervention data.

Analysis of Pre- and Post-Intervention Scores: No significant differences ($p \geq 0.05$) were found in the control group or in the peer problems and prosocial subscales of the treatment group. However, the treatment group showed significant improvements ($p < 0.05$) in emotional problems, hyperactivity-inattention, and total difficulties, while no significant changes were observed in behavioral problems, peer problems, and prosocial subscales (Table 1).

Table No.1: Emotional Condition Before and After Sensory Integration Therapy: Comparison of Pre- and Post-Intervention Scores

		Median (minimum-maximum) Mean ± Standard Deviation		
		Pretest	Posttest	P value
Control group	SDQ emotional problem	5 (3-6)	5 (4-6)	0,317 [a]
	SDQ behavioral problem	3 (1-5)	3 (1-5)	1,000 [a]
	SDQ hyperactivity-inattention	5 (5-7)	6 (5-7)	0,317 [a]
	SDQ peer problems	2 (1-4)	2 (1-4)	1,000 [a]
	SDQ difficulty domain	16 (11-20)	16 (12-20)	0,157 [a]
	SDQ prosocial	6 (5-8)	6 (5-8)	1,000 [a]
Intervention group	SDQ emotional problem	6,43 ± 1,397	3,43 ± 1,902	0,002 [b]
	SDQ behavioral problem	2,86 ± 2,854	1,86 ± 1,773	0,062 [b]
	SDQ hyperactivity-inattention	5,57 ± 1,718	3,57 ± 1,813	0,006 [b]
	SDQ peer problems	5 (0-7)	3 (0-6)	0,102 [a]
	SDQ difficulty domain	18,71 ± 6,157	12,14 ± 5,900	0,001[b]
	SDQ prosocial	7 (1-10)	9 (1-10)	0,317 [a]
a= Wilcoxon test b= paired t-test				

Table No.2. Comparison of Emotional Conditions Between Control and Intervention Groups

		Median (minimum-maximum) Mean ± Standard Deviation		
		Control group	Intervention group	P value
Pretest	SDQ emotional problem	4,71 ± 1,113	6,43 ± 1,397	0,026 [a]
	SDQ behavioral problem	3,00 ± 1,528	2,86 ± 2,865	0,909 [a]
	SDQ hyperactivity-inattention	5 (5-7)	5 (4-8)	0,642 [b]
	SDQ peer problems	2 (1-4)	5 (0-7)	0,155 [b]
	SDQ difficulty domain	16 (11-20)	22 (10-24)	0,223 [b]
	SDQ prosocial	6,57 ± 1,134	6,43 ± 3,259	0,915 [a]
Score difference	SDQ emotional problem	0 (0-1)	-3 (-5-(-1))	0,001 [b]
	SDQ behavioral problem	0 (0-0)	-1 (-3-0)	0,025 [b]
	SDQ hyperactivity-inattention	0 (0-1)	-2 (4-0)	0,003 [b]
	SDQ peer problems	0 (0-0)	0 (-2-0)	0,061 [b]
	SDQ difficulty domain	0 (0-1)	-6(-11- (-3))	0,001 [b]
	SDQ prosocial	0 (0-0)	0 (0-2)	0,317 [b]
a = two sample t-tests b = Mann-Whitney test				

Comparison Between Control and Treatment Groups: Before therapy, significant differences ($p<0.05$) were found between the control and treatment groups only in the emotional problems subscale, while other subscales showed no differences ($p\geq0.05$). After therapy, significant differences ($p<0.05$) were observed in emotional problems, behavioral problems, hyperactivity-inattention, and total difficulties, while peer problems and prosocial subscales remained unchanged ($p\geq0.05$) (Table 2).

DISCUSSION

Emotional regulation disorders affect approximately 25–45% of children with ADHD, often manifesting as excessive emotional responses that are inappropriate for the social context or developmental stage.[10] These challenges are frequently associated with sensory processing difficulties, which can contribute to the development of emotional and behavioral problems, particularly in children who tend to internalize emotions, such as girls.[15,17]

This study observed a higher proportion of male participants (71.4%) compared to females (28.6%), which aligns with previous research indicating that ADHD symptoms are more easily detected in boys during childhood.[5,18,19] This discrepancy is largely due to differences in symptom presentation between genders. Boys with ADHD tend to exhibit more overt hyperactive and impulsive behaviors, which are more noticeable in classroom and home settings, prompting earlier diagnosis. In contrast, girls with ADHD often compensate for symptoms, delaying functional impairment and diagnosis until adolescence or adulthood.[17,18] Their symptoms frequently manifest as emotional difficulties resembling depression or anxiety, making early detection more challenging.[17] Furthermore, parents and teachers may be less adept at recognizing internalizing symptoms in girls, particularly inattention, which is often masked or compensated for and more commonly associated with the inattentive subtype of ADHD.[20,21] These factors likely contributed to the finding that emotional problems were more prominent among female participants in this study.

Screening in this study utilized the ACTRS, a tool assessed by teachers. While ACTRS is effective for detecting externalizing symptoms, prior studies suggest that teacher-based assessments may underestimate internalizing and inattentive symptoms, particularly in girls. Teachers are more likely to notice disruptive behaviors that interfere with classroom activities, whereas subtler signs of ADHD, such as difficulty maintaining attention or emotional dysregulation, may go unnoticed. Some studies recommend incorporating self-report questionnaires to better identify these symptoms in females.[17,21] Future research may benefit from a multi-informant approach, integrating teacher assessments, parent reports, and child self-reports to provide a more comprehensive evaluation of ADHD symptoms and their impact on emotional regulation.

The results demonstrated significant improvements in emotional and behavioral outcomes among children with ADHD symptoms following Sensory Integration Therapy. Compared to the control group, the intervention group showed notable progress in emotional regulation and behavioral adaptation. Sensory Integration Therapy, delivered through sensorimotor games, provides structured stimuli that train children to respond adaptively to sensations, reduce distress, and improve concentration, motor skills, and social relationships. These games help modulate physiological, psychological, and behavioral

states of emotion, which can alleviate ADHD symptoms.[22]

The effectiveness of Sensory Integration Therapy can be attributed to its ability to address underlying sensory processing challenges that contribute to emotional dysregulation. Many children with ADHD exhibit heightened sensitivity to environmental stimuli, leading to increased emotional reactivity and difficulty maintaining attention. By engaging in structured sensorimotor activities, children learn to process and integrate sensory input more effectively, reducing maladaptive emotional responses and improving overall behavior.[12,22] This aligns with previous findings that suggest sensory-based interventions can help children develop better coping strategies, allowing them to navigate their environments with greater ease.

Additionally, the school-based setting of this intervention plays a crucial role in its success by providing a structured and consistent environment where children can receive regular sensory integration sessions as part of their daily routine. Unlike clinical settings, which may present logistical and financial barriers for families, school-based programs ensure accessibility and continuity of care, highlighting the potential for broader implementation of Sensory Integration Therapy, particularly as an early intervention strategy for children displaying ADHD symptoms. The observed improvements in this study underscore the interconnected nature of sensory processing, emotional regulation, and social functioning. Emotional dysregulation in children with ADHD often leads to peer difficulties, classroom disruptions, and increased frustration with academic tasks. By enhancing sensory processing abilities, children become better equipped to self-regulate, leading to improved social interactions and academic performance. This suggests that Sensory Integration Therapy not only mitigates core ADHD symptoms but also fosters overall well-being by promoting self-confidence and adaptive coping mechanisms.

Despite these promising findings, this study has limitations. The small sample size limits generalizability, requiring larger, more diverse studies for confirmation. The non-blinded design may introduce bias, as teachers and parents were aware of group assignments. Reliance on teacher and parent reports may not fully capture children's experiences. Lastly, the study focused on short-term outcomes, leaving long-term effects of Sensory Integration Therapy unexplored.

CONCLUSION

This pilot study demonstrates the potential of school-based Sensory Integration Therapy to improve emotional and behavioral outcomes in children with ADHD symptoms. By addressing sensory processing challenges, it supports emotional regulation, adaptive behaviors, and social skills. While promising, further research is needed to assess long-term effects, refine strategies, and integrate Sensory Integration Therapy into broader ADHD treatment plans. Expanding access to these interventions may significantly benefit children, helping them better navigate academic and social environments.

Author's Contribution:

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