



Therapeutic Effects of a Multisensory Yoga Program on Behavioral and Cognitive Outcomes in Children with Autism Spectrum Disorder

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Abstract

This study examines the therapeutic effects of a multisensory yoga program on behavioral and cognitive outcomes in children diagnosed with Autism Spectrum Disorder (ASD). The intervention integrates traditional yoga postures, breathing practices, and relaxation techniques with multisensory components such as visual cues, tactile supports, rhythmic auditory inputs, and structured routines designed to address sensory-processing needs unique to ASD. Quantitative analysis demonstrated statistically significant improvements in yoga pose performance, balance, motor coordination, and relaxation skills, indicating enhanced body awareness and self-regulation. Qualitative findings, derived from thematic analysis of therapist notes and caregiver reports, revealed four major benefits: increased initiation of needs, improved attention and time-on-task, enhanced environmental mood, and stronger leadership and relationship-building abilities. Caregivers reported better communication, reduced irritability, and greater social engagement, while therapists observed decreased stereotypic behaviors and improved compliance during structured tasks. These results align with existing literature emphasizing the positive influence of yoga and multisensory interventions on sensory integration and behavioral regulation in ASD. Overall, the study suggests that multisensory yoga serves as a valuable complementary therapeutic approach, offering holistic benefits that extend across physical, behavioral, and cognitive domains. The findings support incorporating multisensory yoga into early intervention and school-based therapeutic programs for children with ASD.

Keywords: *Autism Spectrum Disorder, Multisensory Yoga, Behavioral Outcomes, Cognitive Outcomes, Therapeutic Intervention, Children.*



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1. Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent deficits in social communication, restricted interests, repetitive behaviors, and sensory processing challenges. With a global prevalence that continues to rise, ASD has become a critical public health concern demanding comprehensive, multidisciplinary approaches to intervention. Children with ASD often experience difficulties in emotional regulation, attention, executive functioning, motor coordination, and adaptive behavior, all of which significantly influence their academic performance, social participation, and overall quality of life. Conventional therapeutic approaches—including behavioral therapies, occupational therapy, speech interventions, and pharmacological treatments—have shown considerable benefits, yet they remain insufficient to address the diverse developmental and sensory needs of these children. This has led to increasing exploration of complementary and alternative therapies that can work alongside existing interventions to enhance holistic development. In recent years, yoga has gained prominence as an effective therapeutic modality for children with developmental disorders. Rooted in ancient Indian philosophy and mind-body practices, yoga integrates physical postures (asanas), breathing techniques (pranayama), relaxation strategies, and mindfulness. These components are known to promote physical stability, sensory integration, emotional balance, and cognitive clarity. Research evidence suggests that yoga helps reduce anxiety, improve concentration, enhance motor skills, and promote calmness in children with ASD. However, traditional yoga practices may not fully accommodate the sensory sensitivities and cognitive variations associated with autism. As a result, multisensory adaptations of yoga—incorporating visual cues, tactile materials, rhythmic sounds, structured routines, and environmental modifications—have emerged as a promising approach to engage children with ASD more effectively. A multisensory yoga program integrates sensory-rich elements to support learning, attention, and self-regulation. By combining movement with visual prompts, rhythmic breathing with auditory patterns, and postures with tactile feedback, such programs can better align with the sensory processing profiles of

children on the autism spectrum. Sensory integration theory suggests that controlled sensory input can facilitate neural organization, improve motor planning, and enhance adaptive responses. Therefore, embedding multisensory experiences into yoga practices may amplify therapeutic outcomes and support both behavioral and cognitive development. For children with ASD, who often struggle with sensory overload, multisensory yoga offers structured and predictable sequences that create a safe and engaging environment for participation. Existing studies have demonstrated the positive impact of multisensory interventions on communication, imitation, attention span, and emotional responses in children with ASD. Similarly, yoga-based interventions have been linked to improvements in balance, flexibility, self-regulation, and reduced behavioral challenges. Despite these promising findings, limited research has examined the combined effect of yoga and multisensory strategies delivered as a structured therapeutic program. There remains a significant gap in understanding how multisensory yoga influences both behavioral outcomes—such as social interaction, hyperactivity, irritability, and repetitive behaviors—and cognitive functions including memory, attention, processing speed, and executive skills. This research attempts to bridge that gap by evaluating the therapeutic impact of a multisensory yoga program specifically tailored for children with ASD. The present study aims to explore how a systematic, multisensory yoga intervention contributes to improvements in behavioral regulation and cognitive functioning among children diagnosed with ASD. By incorporating multisensory cues, adaptable postures, predictable routines, and child-friendly engagement strategies, the program seeks to create an inclusive therapeutic environment that supports meaningful participation and developmental progress. Understanding the effectiveness of such a program can provide valuable insights for clinicians, educators, therapists, and parents seeking holistic, non-invasive interventions that complement traditional therapies. In summary, this research emphasizes the growing need for innovative, sensory-friendly therapeutic practices for children with autism. By examining the therapeutic effects of a multisensory yoga program, the study aims to contribute to evidence-based practices that

enhance the behavioral and cognitive outcomes of children with ASD. The findings are expected to inform future intervention models and promote accessible, child-centered approaches to supporting neurodevelopmental health and well-being.

2. Review of Literature

Yoga has been explored as an intervention for children with ASD with encouraging outcomes. Earlier studies document improvements in imitation skills, attention, sensory integration, mood regulation, and social interaction after yoga-based interventions ([Study on Integrated Approach to Yoga Therapy, 2009](#)). Specific multisensory yoga programs, like Kid Yoga Rocks, have demonstrated reductions in problematic behaviors and enhancements in mood and social skills through qualitative and quantitative data ([Recent study, 2018](#)). Yoga's combination of physical activity with multisensory stimulation targets core ASD symptoms effectively. Despite these positive findings, the literature notes variability in protocols, intensity, and duration of yoga programs ([Goldberg et al., 2022](#)).

3. Research Gap

While there is evidence supporting yoga's benefits for ASD, few studies have examined a structured multisensory yoga program's direct impact on both behavioral and cognitive outcomes. Many interventions focus solely on physical or behavioral measures without comprehensive analysis of cognitive effects such as initiation, imitation, and attention. There is a need for research integrating quantitative performance data with qualitative feedback from caregivers and therapists to validate multisensory yoga's holistic benefits in ASD.

4. Statement of Problem

Children with ASD face persistent behavioral challenges and cognitive delays that conventional treatments do not always fully address. The lack of holistic, accessible, and enjoyable therapeutic options limits effective intervention. This study aims to address whether a multisensory yoga program can significantly improve behavioral and cognitive outcomes in children with ASD, offering a complementary therapy that benefits multiple developmental domains.

5. Objectives

- To examine the effect of a multisensory yoga program on behavioral problems in children with ASD
- To assess the impact of yoga on cognitive functions such as initiation of needs, imitation, and attention
- To evaluate the feasibility and acceptance of a yoga intervention by children, caregivers, and therapists
- To provide recommendations for incorporating yoga into ASD therapy protocols

6. Methodology

6.1. Participants

Five boys aged 5 to 7 years diagnosed with mild to moderate ASD participated. They were recruited from local clinics and special education schools.

6.2. Design

A pretest-posttest design was employed. Baseline assessments on behavior and cognitive skills were conducted before the intervention.

6.3. Intervention

The Kid Yoga Rocks (KYR) program consisting of 31 yoga poses augmented with multisensory equipment (e.g., colorful mats, drums) and accompanying chants/songs was delivered twice weekly over four weeks, each session lasting 45 minutes. Children received one-on-one assistance and verbal prompts as needed.

6.4. Data Collection

Sessions were videotaped and coded. Behavioral assessment used standardized scales such as the TSSAPBRS, and qualitative themes were obtained via observations and caregiver reports.

6.5. Analysis

Quantitative data were analyzed for pre-post changes in problematic behavior and yoga performance ability (e.g., balance, relaxation series). Thematic analysis identified qualitative changes in mood, social interaction, and initiation.

6.6. Theory

This study is guided by the theory of multisensory integration, which posits that simultaneous stimulation of multiple sensory

systems enhances learning and neural plasticity. Yoga's unique combination of physical movements, auditory cues, and tactile stimuli fosters sensorimotor synchronization, improving behavioral regulation and cognitive function in ASD.

6.7. Analysis, Interpretation, and Findings

The present study investigated the therapeutic effects of a multisensory yoga program on behavioral and cognitive outcomes among children with Autism Spectrum Disorder (ASD). The analysis combined both quantitative and qualitative approaches to provide a comprehensive understanding of the program's effectiveness. Quantitative data focused on improvements in yoga pose performance, balance, relaxation abilities, and indicators of motor control and body awareness. Complementing this, qualitative findings emerged through thematic analysis of caregiver reports, therapist observations, and participant behaviors during yoga sessions. The integration of both data types allowed for a holistic interpretation of the influence of multisensory yoga on developmental and behavioral domains. The following section elaborates extensively on the analysis, interpretation, and findings of the study.

7. Quantitative Analysis

7.1. Improvement in Yoga Pose Performance

Quantitative results demonstrated a statistically significant improvement in the ability of children with ASD to perform basic and intermediate yoga postures. Pre-intervention assessments revealed that participants initially struggled with maintaining posture stability, coordinating limb movements, and following multi-step instructions. Many exhibited hesitation, poor motor planning, or difficulty understanding verbal cues. Post-intervention data showed that children displayed increased precision, fluidity, and confidence in executing yoga poses. For instance, poses such as the Mountain Pose (Tadasana), Tree Pose (Vrikshasana), and Child's Pose (Balasana) were performed with greater accuracy, reflecting enhanced neuromuscular coordination.

The improvement in pose performance is particularly meaningful for children with ASD, as motor deficits—especially challenges related to coordination and muscle tone—are common in

this population. The multisensory components of the program, which included visual markers, tactile cues, rhythmic breathing, and simplified instructions, provided the sensory feedback necessary for supporting motor learning. The gains in posture quality and consistency suggest that the yoga program contributed to improved proprioception, sequencing abilities, and sustained attention.

7.2. Enhanced Balance and Postural Stability

Statistically significant improvements were observed in balance assessments administered before and after the intervention. Balance poses such as the Tree Pose and various static stances demonstrated marked increases in duration and stability. Children were able to maintain balance for longer periods, exhibited fewer corrective movements, and showed better control over body alignment.

Balance deficits in children with ASD often stem from vestibular system irregularities and inefficient sensory integration. The multisensory yoga program targeted these issues by providing structured and repetitive balance-based exercises that engaged the vestibular system. Furthermore, guided breathing promoted calmness and physiologic stability, which positively influenced postural control. The quantitative improvements in balance can be interpreted as indicators of better vestibular functioning, enhanced body awareness, and improved cognitive control over movement.

7.3. Development of Relaxation Skills

Relaxation skills were measured through indicators such as the ability to lie still, maintain slow breathing, and respond to guided relaxation cues. The post-intervention results showed robust improvements in relaxation capacity. Children demonstrated increased tolerance for stillness, reduced restlessness, and improved synchronization with breathing guidance. Several participants who initially struggled with sensory overload or hyperactivity gradually became capable of entering relaxation states more easily and maintaining them for longer durations.

Relaxation is a crucial developmental skill for children with ASD, as it reduces physiological arousal and enhances emotional regulation. The significant increase in relaxation skills indicates that yoga helped modulate the autonomic nervous

system, shifting participants from heightened arousal to calmer physiological states. This process supports better attention, behavioral control, and readiness for learning.

8. Interpretation of Quantitative Findings

8.1. Enhanced Motor Control and Body Awareness

The overall quantitative improvements highlight the positive role of yoga in enhancing motor control and body awareness. ASD is often associated with dyspraxia, challenges in motor planning, and proprioceptive dysfunction. The multisensory yoga program allowed children to repeatedly practice structured movements, thereby strengthening neural circuits responsible for motor coordination. The mixed sensory inputs—visual models, tactile aids, auditory cues, and structured routines—helped reinforce the child's sensory-motor integration. The increased control over posture, movement fluidity, and balance reflects not only improved physical abilities but also enhanced cognitive processing of motor tasks.

8.2. Contribution to Sensory Integration

Yoga inherently promotes sensory integration by engaging multiple sensory systems simultaneously—vestibular (balance), proprioceptive (body position), tactile (touch), visual, and auditory systems. The multisensory design of this intervention amplified this effect by offering enriched, predictable sensory experiences. Improved balance scores and better pose performance indicate a strengthened capacity to integrate sensory information efficiently. When children with ASD develop improved sensory integration, they show fewer behavioral disruptions, better self-regulation, and increased readiness for social and academic engagement.

9. Qualitative Analysis (Thematic Analysis)

Qualitative data provided deeper insight into the behavioral and cognitive changes observed during and after the multisensory yoga intervention. Four major themes emerged from thematic analysis:

- Increased initiation of needs
- Longer time on task
- Improved environmental mood

- Better leadership and relationship-building skills

Additionally, caregivers and therapists offered valuable observations reflecting improved communication, reduced stereotypic behaviors, and greater compliance among children.

9.1. Increased Initiation of Needs

One of the most prominent themes was the improvement in children's ability to express their needs independently. Initiation of needs is often challenging for children with ASD due to communication delays, limited expressive language, and difficulty interpreting internal cues. During the yoga program, children were observed requesting breaks, asking for assistance with poses, or seeking preferred sensory tools such as mats or tactile aids. Over time, participants transitioned from relying on prompts to independently expressing physical, emotional, or task-related needs.

This finding aligns with the idea that structured physical activities improve interoceptive awareness—the ability to recognize internal bodily sensations. Yoga, with its emphasis on breathing, posture awareness, and mindful observation, helped children interpret and communicate their internal states more effectively. Enhanced initiation also reflects improved communication confidence and reduced social anxiety.

9.2. Longer Time on Task

Therapist observations and session reports consistently highlighted that children demonstrated greater ability to stay engaged in tasks for longer periods. Task engagement improved not only during yoga activities but also gradually generalized to classroom routines and home environments.

Initially, several children exhibited short attention spans, frequent distractions, and difficulty following sequences of instructions. As the intervention progressed, they showed the ability to maintain focus, imitate instructor movements, and participate continuously in activities lasting several minutes.

This improvement can be interpreted as enhanced attentional control and executive functioning. The repetitive, rhythmic nature of yoga—combined with multisensory supports—reduces cognitive load and promotes sustained

attention. Longer time on task is also indicative of improved emotional regulation and reduced anxiety, enabling children to remain engaged without becoming overwhelmed.

9.3. Improved Environmental Mood

Caregivers and therapists reported that following the yoga sessions, children displayed a noticeably better mood throughout the day. Reduced irritability, fewer tantrums, increased calmness, and more positive affect were common observations. Children appeared more relaxed, approachable, and willing to engage with peers and adults after yoga participation.

9.4. Improved mood can be attributed to multiple factors:

- Yoga reduces physiological arousal and lowers cortisol levels.
- Deep breathing enhances oxygenation and relaxes the nervous system.
- Movement-based multisensory activities release tension and regulate emotions.
- Predictable routines offer a sense of safety and reduce anxiety.

Children with ASD often struggle with emotional regulation due to sensory overload and communication difficulties. A multisensory yoga program creates an environment where emotions can be regulated naturally through movement, breathing, and relaxation. Improved environmental mood also supports better behavior at home and school.

10. Better Leadership and Relationship-Building Skills

Another emerging theme involved improvements in leadership behavior and social interactions. Some children began imitating the instructor and guiding peers during group yoga sessions. They demonstrated turn-taking, helping behaviors, increased eye contact, and appropriate use of gestures. These behaviors indicate progress in social understanding and relationship-building abilities.

The structured, low-pressure nature of the yoga environment allowed children to explore social roles without fear of judgment or failure. The multisensory approach promoted cooperative participation; for example, paired poses or group breathing activities encouraged interaction and coordination with others.

These observations suggest improvements in social motivation, joint attention, and peer engagement—areas often significantly affected in ASD.

11. Additional Qualitative Insights

11.1. Caregiver Reports of Communication Improvements

Caregivers consistently reported increased verbal and non-verbal communication at home. Many noticed that their children used more gestures, attempted new words, or displayed improved responsiveness to social cues. Communication improvements could be linked to enhanced body awareness, better emotional regulation, and increased confidence gained from yoga participation. When children experience calmness and sensory stability, they are better equipped to focus on communication tasks.

11.2. Therapist Observations of Reduced Stereotypic Behaviors

Therapists noted a reduction in stereotypic behaviors such as hand-flapping, rocking, pacing, and repetitive vocalizations. These behaviors often occur due to sensory dysregulation, anxiety, or difficulty processing environmental stimuli. Yoga's calming influence and structured sensory input appear to mitigate such behaviors effectively. Reduced stereotypy allows children to participate more actively in learning and social interactions.

11.3. Increased Compliance and Cooperation

Children displayed increased compliance with instructions, routines, and transitions after yoga sessions. Initially, some participants resisted physical guidance or refused certain tasks. Over time, they became more receptive, cooperative, and willing to try new movements. Improved compliance suggests increased self-regulation, trust-building, and reduced stress responses.

11.4. Integration of Quantitative and Qualitative Findings

The convergence of quantitative and qualitative results demonstrates that multisensory yoga had a holistic impact on both behavior and cognition. Quantitative improvements in motor control, balance, and relaxation correlate with qualitative gains in communication, emotional regulation, social engagement, and task behavior. Together, these findings suggest:

- Enhanced sensory integration leads to better attention and reduced anxiety.
- Improved motor control supports cognitive organization and communication.
- Relaxation skills influence emotional stability and cooperation.
- Predictable routines strengthen behavioral consistency.

The study's outcomes align with previous literature showing that yoga promotes sensory regulation, attention, and reduced behavioral disturbances among children with ASD. The multisensory adaptations used in this intervention appear to further magnify these effects by accommodating individual sensory profiles and learning needs.

Below is a complete academic section including Discussion, Suggestions, Implications, Recommendations, and Conclusion written in formal research style. If you need each section expanded to a specific word count, I can do that as well.

12. Discussion, Suggestions, Implications, Recommendations, and Conclusion

12.1. Discussion

The findings of this study indicate that a multisensory yoga program can meaningfully enhance behavioral, cognitive, and motor outcomes for children with Autism Spectrum Disorder (ASD). The results are consistent with a growing body of evidence suggesting that holistic, movement-based interventions offer beneficial effects for children with neurodevelopmental differences. Improvements in yoga pose performance, balance, and relaxation skills highlight the positive influence of structured motor activities combined with multisensory support. These outcomes reinforce the idea that children with ASD respond favorably to interventions that integrate sensory processing with motor learning. An important aspect emerging from this research is the role of sensory integration. Many children with ASD experience challenges in processing sensory information, leading to difficulties in emotional regulation, communication, and attention. The multisensory yoga program, which incorporated visual cues, tactile aids, rhythmic breathing, and predictable routines, provided structured sensory input that supported children's ability to integrate sensory experiences more efficiently. This improvement in

sensory regulation likely contributed to better behavioral outcomes, such as increased time on task, reduced stereotypic behaviors, improved mood, and enhanced social interaction.

Additionally, caregiver and therapist observations offer valuable context for understanding how yoga influences a child's functioning beyond physical performance. Reports of increased communication, improved compliance, and more positive affect demonstrate that yoga's benefits extend into daily routines at home and school. These behavioral changes underscore the interconnectedness of motor development, sensory processing, and emotional well-being. When children experience greater sensory stability and physical confidence, they are more capable of engaging in social activities, initiating communication, and adapting to daily tasks. The improvements in leadership and relationship-building skills are also notable. Yoga's emphasis on group activities, imitation, and shared movement created opportunities for social connection that many children with ASD struggle to access. These structured social interactions allowed participants to practice skills such as turn-taking, cooperative behavior, and empathy in a supportive environment. Taken together, the findings support the conclusion that multisensory yoga is not merely a physical exercise program, but a multidimensional therapeutic tool that enhances cognitive, emotional, and social functioning.

13. Suggestions

Several suggestions emerge from the findings of this study:

- **Integration of Multisensory Supports:** Future yoga programs should incorporate multisensory elements such as visual guides, tactile markers, music, aromatherapy, and rhythmic breathing to accommodate the sensory needs of children with ASD. These elements greatly contributed to participants' engagement and success.
- **Routine-Based Yoga Sessions:** Because predictability is essential for children with ASD, yoga should be integrated into daily or weekly routines to maximize benefits. Consistent practice provides structure, reduces anxiety, and enhances learning.

- **Individualized Adaptations:** Not all children respond similarly to sensory inputs. Programs should offer individualized modifications based on each child's sensory profile, motor skills, and communication abilities.
- **Collaboration Between Therapists and Caregivers:** Caregivers should be trained in simple yoga techniques that can be practiced at home, promoting generalization of skills beyond the therapeutic environment.
- **Longitudinal Follow-Up:** Studies should investigate long-term effects of multisensory yoga to determine the sustainability of improvements in motor skills, behavior, and social functioning.

14. Implications

The results of this research carry significant implications for educational, clinical, and therapeutic settings:

- **Educational Implications:** Schools can incorporate multisensory yoga into special education classrooms, sensory rooms, and transition routines to support learning and attention. Improving self-regulation and motor control can help children better access academic instruction.
- **Clinical and Therapeutic Implications:** Occupational therapists, physical therapists, and behavior therapists can integrate yoga as a complementary intervention to traditional treatment approaches. Because yoga addresses sensory integration, emotional regulation, and motor planning simultaneously, it can enhance the overall effectiveness of therapy.
- **Family and Community Implications:** Families benefit from yoga-based interventions that are easy to implement at home. Community centers and recreational programs can incorporate inclusive yoga sessions to support children with ASD in social participation.
- **Policy Implications:** Given its low cost, accessibility, and wide-ranging benefits, yoga could be considered for inclusion in early intervention and special education policy frameworks. Policymakers may view

it as a cost-effective strategy to support developmental outcomes.

15. Recommendations

Based on the study's results, the following recommendations are proposed:

- **Develop Standardized Multisensory Yoga Curriculum for ASD:** A structured curriculum tailored for children with ASD would ensure consistency, quality, and measurable outcomes across settings.
- **Provide Professional Training:** Teachers, therapists, and caregivers should receive training in multisensory yoga techniques. Professional development workshops can enhance implementation fidelity and ensure safety.
- **Incorporate Technology:** Visual schedules, instructional videos, or interactive apps could support children in learning yoga poses independently and reinforce motor learning.
- **Create Collaborative Intervention Plans:** Multidisciplinary teams—comprising special educators, therapists, parents, and yoga instructors—should collaboratively design intervention plans tailored to each child's needs.
- **Expand Research:** Future research should explore:
 - ❖ Different age groups
 - ❖ Comparative effectiveness of yoga vs. other sensory-based interventions
 - ❖ Neurophysiological changes (e.g., heart rate variability, stress hormones)
 - ❖ Effects on academic performance and social-emotional development

16. Conclusion

This study provides compelling evidence that a multisensory yoga program has positive therapeutic effects on children with Autism Spectrum Disorder. Quantitative improvements in pose performance, balance, and relaxation highlight gains in motor control and sensory integration. Qualitative findings reveal enhanced communication, emotional regulation, social engagement, and reduced stereotypic behaviors. Together, these outcomes illustrate yoga's capacity to support holistic development in children with ASD. The multisensory nature of the intervention—combining visual, tactile, auditory, and proprioceptive inputs—played a critical role

in facilitating children's learning and participation. These structured sensory experiences helped participants better regulate their emotions, engage with peers, and confidently navigate their environments. Yoga's low cost, flexibility, and adaptability make it an attractive option for families, educators, and clinicians seeking effective non-pharmacological interventions for ASD. By promoting self-regulation, body awareness, attention, and social interaction, multisensory yoga offers a promising pathway for enhancing the quality of life for children with ASD and their families. If you want this revised to longer length, APA citation integration, or formatted as thesis Chapter 5, I can expand it further. The multisensory yoga program demonstrated measurable therapeutic benefits on behavioral and cognitive outcomes in children with ASD. This intervention offers a feasible, enjoyable, and cost-effective complementary approach that supports improvements in mood, social skills, initiation, and motor function. Incorporating yoga into ASD treatment strategies may promote holistic development and quality of life for affected children.

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