IJMRT: Volume (7), Issue 4, 2025
International Journal of Multidisciplinary Research Transactions
(*A Peer Reviewed Journal*)
www.ijmrt.in

ISSN (Print):2663-2381
ISSN (Online):2663-4007

Behavioral Interventions for Reducing Self-Stimulatory Behaviors in Children with Autism and Developmental Delay: A Systematic Review

Sreedevi Basaboina[1]*, Dr. G. Sri Krishna[2]

[1]Ph.D. Research Scholar, Department of Psychology, Osmania University, Hyderabad, Telangana, India.
[2]Ex-faculty, National Institute for the Empowerment of Persons with Intellectual Disabilities (NIEPID), Hyderabad, Telangana, India.

*Corresponding Author

DoI: https://doi.org/10.5281/zenodo.15188434

Abstract

Children with developmental delays (DD) and autism spectrum disorder (ASD) exhibit self-stimulating actions such hand-flapping and rocking, which limit both learning and social interactions. Using PRISMA 2020 norms, this investigation seems at behavioral strategies that efficiently reduced such behaviors. Research utilizing six databases (2000-2024) yielded 68 suitable studies which included randomized controlled trials (RCTs), single-case experimental designs and quasi-experimental studies. The reviewed interventions fell into reinforcement-based strategies (including differential reinforcement together with functional communication training (FCT) and antecedent-focused techniques (such as response interruption with sensory adaptations) as well as hybrid approaches. Research results showed that reinforcement-based methods specifically FCT demonstrated the most significant empirical evidence (Hedges' g = 0.65–1.20) but the effectiveness of antecedent-focused approaches depended on individual sensory profiles. Research data from subgroup analysis demonstrated that sensory-intervention requirements should be personalized since environmental enrichment works best for children with hypo-responsivity. Research study assessment for bias risks found moderate concerns in 45% of cases because of either insufficient participant numbers or study participants being aware of their treatment condition. This study demonstrates the importance of sensory

intervention and behavioral approaches in combination to boost outcomes so both approaches should be applied individually for each person. The recommendations propose functional assessment-based reinforcement approaches together with sensory profiling sessions for strategies that focus on increasing effectiveness while understanding cultural needs. The research findings require clinicians and researchers and policymakers to unite their efforts to build evidence-based complete interventions that will boost developmental progress in children with ASD and DD.

Keywords: Autism Spectrum Disorder, Developmental Delay, Self-Stimulatory Behaviors, Stereotypy, Behavioral Interventions, Systematic Review.

1. Introduction

Self-stimulatory behaviors, commonly referred to as "stereotypies" or "stimming," involve repetitive and seemingly purposeless actions, including hand-flapping, rocking, or vocalizations. These behaviors are often observed in children diagnosed with autism spectrum disorder (ASD) and developmental delays (DD) (Bodfish et al., 2000; Goldman et al., 2009). Although these behaviors may serve self-regulatory or sensory-modulating roles, their excessive nature can disrupt learning, social interactions, and adaptive functioning (Lam et al., 2008; Lovaas et al., 1987). Hence, minimizing the frequency of self-stimulatory behaviors has been the main purpose of behavioral interventions designed to enhance developmental outcomes in this population. Various behavioral strategies, including applied behavior analysis (ABA), differential reinforcement, response interruption and redirection (RIRD), and functional communication training (FCT), have been empirically evaluated for their efficacy in mitigating these behaviors (Ahearn et al., 2007; Falcomata et al., 2013). However, the heterogeneity of intervention approaches, study designs, and participant characteristics complicates the synthesis of best practices. Previous reviews have highlighted the effectiveness

of reinforcement-based and antecedent-based interventions (Lang et al., 2010; Rapp & Vollmer, 2005), yet an updated, systematic examination is needed to consolidate recent findings and identify gaps in the literature.

This systematic review aims to critically evaluate the current evidence on behavioral interventions for reducing self-stimulatory behaviors in children with ASD and DD. By synthesizing outcomes across studies, we seek to clarify which strategies demonstrate the strongest empirical support, assess the generalizability of findings, and provide recommendations for clinicians and researchers. Additionally, we discuss potential moderators of treatment efficacy, such as intervention intensity, individual sensory profiles, and co-occurring conditions, to inform more personalized approaches to intervention. This systematic review is also grounded in the principles of applied behavior analysis (ABA) and sensory processing theory, which provide complementary lenses for understanding and addressing self-stimulatory behaviors in children with autism and developmental delays. From a behavioral perspective, ABA posits that self-stimulatory behaviors are maintained by either automatic reinforcement (sensory consequences) or social reinforcement, and thus can be modified through reinforcement-based strategies, extinction, or replacement behaviors (Iwata et al., 1994; Rapp & Vollmer, 2005). Interventions such as differential reinforcement of alternative behaviors (DRA) and response interruption/redirection (RIRD) are rooted in operant conditioning, emphasizing the role of environmental contingencies in shaping behavior. Concurrently, sensory processing theory suggests that self-stimulation serves a regulatory function, helping children modulate arousal levels in response to sensory over- or under-stimulation (Baranek et al., 2006; Leekam et al., 2011). This framework acknowledges that some behaviors may be intrinsic to neurological differences, necessitating interventions that address sensory needs rather than solely suppressing motor or vocal stereotypy. By integrating

these perspectives, this review evaluates behavioral interventions not only in terms of their efficacy in reducing undesired behaviors but also in their ability to promote functional alternatives that fulfill similar sensory or regulatory needs, thereby supporting a more holistic approach to intervention.

2. Background on the Topic

Children diagnosed with autism spectrum disorder (ASD) and developmental delays (DD) frequently show the behavior pattern of self-stimulation with continuous movement of the body and vocalization along with object-handling. Although their potent occurrence impacts functioning and learning associated social abilities, evidence reveals these repetitive behaviors that we term stereotypies help control sensory events and emotional states as well as cognitive activities (Bodfish et al., 2000; Goldman et al., 2009). Sometimes self-stimulating activities that are not harmful need to be reduced in order to acquire skills or to avoid undesirable social attention; therefore, these behaviors become targets of common interventions (Ahearn et al., 2007; Rapp & Vollmer, 2005).

3. Importance of the Problem

Self-stimulating actions must be controlled since they limit social interaction and can lead to social discrimination and eliminate from society, so preventing educational and therapeutic participation (Lam et al., 2008). According to Smith & Matson (2010), the absence of effective interventions allows self-stimulating activities to develop long-term problems inhibiting both independence and the general quality of life. Since ASD and DD behaviors repeatedly rise in frequency, evidence-based techniques are required for managers of clinicians and caregivers which include teachers to regulate them.

4. Rationale for the Review

A wide spectrum of behavioral treatment approaches suggested for minimizing self-stimulating behaviors lead to in findings distributed over several studies with varied methodologies that confound the identification of good practice. Examining previous research on specific approaches (note response interruption alongside sensory integration) did not translate into methodical assessments of current intervention strategies (Lang et al., 2010; Falcomata et al., 2013).

5. Related Literature

Existing research on self-stimulatory behaviors in children with ASD and DD has predominantly focused on understanding their etiology and evaluating interventions grounded in behavioral and sensory frameworks. Early work by Bodfish et al. (2000) established that repetitive behaviors in autism differ qualitatively from those in intellectual disability, suggesting unique neurobiological underpinnings. Behavioral interventions, particularly those rooted in applied behavior analysis (ABA), have historically dominated the literature, with studies demonstrating the efficacy of techniques such as differential reinforcement (Ahearn et al., 2007) and response interruption/redirection (Falcomata et al., 2004) in reducing stereotypies. These approaches align with operant conditioning principles, positing that self-stimulatory behaviors are maintained by automatic or social reinforcement (Iwata et al., 1994). Concurrently, sensory processing theory has gained traction, with Baranek et al. (2006) and Leekam et al. (2007) emphasizing that such behaviors may serve regulatory functions, such as managing sensory overload or seeking stimulation. This dual perspective has spurred hybrid interventions, such as functional communication training (FCT) paired with sensory accommodations, though evidence for their synergy remains limited (Lang et al., 2012). Previous systematic reviews (e.g., Rapp & Vollmer, 2005; Lang et al., 2010) have synthesized

subsets of this literature, yet their scope is constrained by dated evidence or narrow foci (e.g., exclusive emphasis on reinforcement or sensory strategies). Recent studies increasingly highlight the role of individualized approaches, particularly for children with co-occurring sensory processing differences, but gaps persist in understanding moderators such as age, severity, and intervention context. This review builds on prior work by systematically comparing the efficacy of diverse behavioral strategies, integrating sensory and behavioral paradigms, and addressing methodological heterogeneity to advance evidence-based recommendations.

6. Objectives

This systematic review aims to:

1. Evaluate the efficacy of behavioral interventions in reducing self-stimulatory behaviors in children with ASD and DD.
2. Compare the effectiveness of different intervention strategies (e.g., reinforcement-based, antecedent-based, sensory-focused).
3. Examine moderating factors (e.g., age, severity, co-occurring conditions) that influence intervention outcomes.
4. Provide evidence-based recommendations for practitioners and highlight areas requiring further investigation.

7. Information Sources

Six-database online searches that include PubMed, Scopus, PsycINFO, ERIC, Web of Science, and ProQuest Dissertations and Theses Global were utilized in the study. The recommended internet resources offered a wide range of behavioral and psychiatric as well as educational literature on autism spectrum disorders including developmental therapies. Research studies

outside of the first database search results have been identified by means of reference list manual reviews of key publications coupled with Google Scholar forward citation tracking. The study scope was January 2000 to March 2024 since it aimed to include both classic and contemporary data on behavioral techniques for self-stimulating endeavors.

7.1. Search Strategy

The search strategy utilized a combination of keywords and MeSH/Emtree terms related to three core concepts: (1) *population* (e.g., "autism spectrum disorder," "developmental delay"), (2) *behavior* (e.g., "self-stimulatory behavior," "stereotypy," "repetitive behavior"), and (3) *intervention* (e.g., "applied behavior analysis," "response interruption," "sensory integration"). Boolean operators (AND/OR) were applied to refine results, and filters restricted outputs to English-language, peer-reviewed articles.

7.2. Study Selection

Two phases according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines contributed us execute the study selection process. In an identical screening of titles and abstracts, two unbiased reviewers processed studies depending on eligibility criteria using Rayyan systematic review software. Articles based on preliminary criteria went on full-text review. Reviewers independently went through perform text evaluation a second time, and then collaborated to resolve contradictions with additional assistance from a third reviewer. By use of two independent reviewers whose agreement exceeded $\kappa > 0.80$ to show great consistency, Cohen's κ helped to assess inter-rater reliability. During the full-text review process, we recorded with appropriate reasoning the studies we omitted (e.g., non-behavioral intervention or unfit population). Starting from identification to retention, the systematic review flow follows a Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) structure, therefore illustrating the quantity of records at each level.

7.3. Data Extraction

Data were extracted using a predefined form developed in Microsoft Excel, capturing:

- **Study characteristics**: Author(s), publication year, country, study design.
- **Participant details**: Sample size, age range, diagnostic criteria, co-occurring conditions.
- **Intervention specifics**: Type (e.g., ABA, FCT), duration, frequency, setting (e.g., clinic, school), and implementer (e.g., therapist, parent).
- **Outcomes**: Metrics used to measure self-stimulatory behaviors (e.g., frequency counts, standardized scores), follow-up data, and adverse effects.
- **Study design**: Experimental controls, blinding, and fidelity measures. Researcher/reviewer independently extracted data, resolving discrepancies through consensus or consultation with a third reviewer. Tools like Distiller SR were used to automate and standardize extraction for large datasets.

7.4. Data Synthesis

The findings were synthesized broadly, grouped by intervention type (e.g., sensory-based vs. reinforcement-based), with respect to various study designs and outcome measures. With effect sizes (e.g., standardized mean differences, Hedges' g) established for primary outcomes, a random-effects meta-analysis was carried out using RevMan 5.4 for RCTs and quasi-experimental studies with similar metrics. A moderator which involves age, intervention intensity, and ASD severity has been investigated by subgroup analyses. For assessing resilience, sensitivity analyses excluded high-risk experiments. Visual analysis and non-overlap techniques (e.g., Tau-U) helped SCEDs to be compiled. Thematic analysis

demonstrated shared implementation difficulties and contextual elements affecting effectiveness.

Designed to enhance the quality and openness of systematic reviews and meta-analyses, PRISMA preferred reporting items for systematic reviews and meta-analyses stands for It offers a 27-item checklist and a flow diagram to help researchers to precisely document every phase of the review process study discovery, screening, eligibility evaluation, and final inclusion. Widely adopted in disciplines like health sciences, education, and social research, PRISMA guarantees that reviews are methodologically sound, thorough, and repeatable.

1,844 Records Identified

|

629 Duplicates Removed

|

1,215 Records Screened

|

1,028 Excluded (Title/Abstract)

|

187 Full-Text Articles Assessed

|

119 Excluded (Reasons Above)

|

68 Studies Included in Synthesis

Figure.1. PRISMA Flow Diagram

The process of determining a study is summed up on a PRISMA flow diagram First database searches turned up 1,532 entries; 312 more studies were found using citation surveillance. 1,215 titles/abstracts were examined after duplicates were eliminated; 187 advanced for full-text review. Of these, 68 studies satisfied qualifying requirements and were synthesized. Inappropriate populations (n = 42), non-behavioral therapies (n = 35), and inadequate outcome data (n = 22) were common causes for exclusion during full-text review.

Identification: Records identified through database searching were-1,532; additional records identified through citation tracking/manual searches-312; total records identified-1,844

Screening: Duplicates removed–629; Titles/abstracts screened- 1,215; Titles/abstracts excluded: 1,028 (irrelevant to SSBs, non-ASD/DD populations, or non-behavioral interventions).

Eligibility of Full-text articles assessed for eligibility: 187; full-text articles excluded- 119. Ineligible population identified- 42 (e.g., adults, non-ASD/DD diagnoses). Non-behavioral interventions- 35 (e.g., pharmacological, sensory integration without BM). Insufficient outcome data were 22 (e.g., missing SSB metrics); other reasons: 20 (e.g., non-English, case reports)

7.5. Thematic Synthesis

Findings were organized into three themes:

1. **Reinforcement-Based Interventions**: Thirty-two studies (47%) evaluated strategies like differential reinforcement of alternative behavior (DRA) or non-contingent

reinforcement (NCR), reporting moderate-to-large reductions in self-stimulatory behaviors (Hedges' g = 0.65–1.20).

2. **Antecedent-Focused Approaches**: Twenty studies (29%) tested sensory modifications (e.g., environmental enrichment) or response interruption/redirection (RIRD), with mixed efficacy (effect sizes: g = 0.30–0.85).
3. **Functional Communication Training (FCT)**: Sixteen studies (24%) demonstrated significant reductions when self-stimulation was replaced with communication (e.g., manding), particularly in children with expressive language skills. Subgroup analyses indicated stronger effects for interventions tailored to sensory profiles (e.g., sensory-specific modifications for hypo-responsive children). Risk of bias assessments revealed moderate concerns in 45% of studies, primarily due to inadequate blinding or small samples.

8. Discussion

8.1. Comparison with Existing Literature

This review supports earlier studies by Rapp and Vollmer and Lang et al presenting great efficacy of reinforcement-based strategies whereas sensory-based strategies attract more interest.

Notably, antecedent modifications (e.g., sensory diets) yielded variable outcomes, aligning with debates about their mechanistic underpinnings (Baranek et al., 2006).

8.2. Strengths and Limitations

Strengths include a rigorous, protocol-driven methodology and inclusion of diverse study designs (RCTs, SCEDs). Limitations encompass heterogeneity in outcome measures, potential

publication bias favoring positive results, and underrepresentation of minimally verbal children.

8.3. Implications

- **Practice**: Clinicians should prioritize reinforcement-based interventions but integrate sensory assessments to personalize strategies.
- **Research**: Future studies should standardize outcome metrics, explore long-term maintenance, and address gaps in culturally adaptive interventions.

This review synthesizes evidence that behavioral interventions particularly reinforcement-based and functionally informed approaches can effectively reduce self-stimulatory behaviors in children with Autism Spectrum Disorder /Developmental Delay. However, efficacy is modulated by individual sensory needs and intervention context. Clinicians are urged to adopt flexible, multi-modal strategies, while researchers should investigate mechanisms of sensory-behavioral interplay and longitudinal outcomes.

The findings of this systematic review underscore the efficacy of behavioral interventions in reducing self-stimulatory behaviors among children with Autism Spectrum Disorder and developmental delays, while also highlighting critical nuances in their application. Reinforcement-based strategies, such as differential reinforcement and functional communication training (FCT), emerged as the most consistently effective approaches, aligning with prior reviews emphasizing operant conditioning principles (Rapp & Vollmer, 2005; Lang et al., 2012). However, the variable success of antecedent-focused interventions (e.g., sensory modifications) reflects ongoing debates about the sensory underpinnings of stereotypies. While some studies reported significant reductions through environmental enrichment or response interruption (Falcomata et al., 2004), others found limited effects, suggesting that sensory interventions may require greater personalization to individual profiles

(Baranek et al., 2006). This heterogeneity underscores the need for comprehensive functional assessments to determine whether behaviors are sensory-driven or maintained by social reinforcement, as posited by sensory processing theory (Leekam et al., 2007).

Strengths of this review include its adherence to PRISMA guidelines, inclusion of diverse study designs (e.g., Randomized Controlled Trials (RCTs), Single-Case Experimental Designs (SCEDs), and synthesis of recent evidence (2000–2024). However, limitations must be acknowledged. Heterogeneity in outcome measures (e.g., frequency counts vs. standardized scales) complicates direct comparisons, and publication bias may over represent positive findings. Additionally, few studies addressed long-term maintenance of effects or included minimally verbal children, limiting generalizability to broader Autism Spectrum Disorder populations.

9. Conclusions

This systematic review consolidates evidence that behavioral interventions particularly reinforcement-based approaches and FCT can effectively reduce self-stimulatory behaviors in children with ASD and developmental delays. However, success hinges on individualized strategies that account for sensory needs, communication abilities, and environmental contexts. Clinicians are urged to adopt a flexible, multi-modal framework, combining reinforcement with sensory supports where appropriate. For researchers, addressing gaps in long-term efficacy, cultural relevance, and mechanistic studies of sensory-behavioral interplay remains paramount. By bridging behaviorist and sensory perspectives, this field can advance toward more holistic, personalized interventions that enhance developmental trajectories and quality of life for children with ASD/DD.

REFERENCES

[1]. Ahearn, W. H., Clark, K. M., MacDonald, R. P. F., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. Journal of Applied Behavior Analysis, 40(2), 263–275. https://doi.org/10.1901/jaba.2007.30-06

[2]. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

[3]. Baranek, G. T., David, F. J., Poe, M. D., Stone, W. L., & Watson, L. R. (2006). Sensory Experiences Questionnaire: Discriminating sensory features in young children with autism, developmental delays, and typical development. Journal of Child Psychology and Psychiatry, 47(6), 591–601. https://doi.org/10.1111/j.1469-7610.2005.01546.x

[4]. Bodfish, J. W., Symons, F. J., Parker, D. E., & Lewis, M. H. (2000). Varieties of repetitive behavior in autism: Comparisons to mental retardation. Journal of Autism and Developmental Disorders, 30(3), 237–243. https://doi.org/10.1023/A:1005596502855

[5]. Falcomata, T. S., Roane, H. S., Hovanetz, A. N., Kettering, T. L., & Keeney, K. M. (2004). An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. Journal of Applied Behavior Analysis, 37(1), 83–87. https://doi.org/10.1901/jaba.2004.37-83

[6]. Goldman, S., Wang, C., Salgado, M. W., Greene, P. E., Kim, M., & Rapin, I. (2009). Motor stereotypies in children with autism and other developmental disorders. Developmental Medicine & Child Neurology, 51(1), 30–38. https://doi.org/10.1111/j.1469-8749.2008.03178.x

[7]. Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2023). Cochrane Handbook for Systematic Reviews of Interventions (Version 6.4). Cochrane. https://training.cochrane.org/handbook

[8]. Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. Journal of Applied Behavior Analysis, 27(2), 197–209. https://doi.org/10.1901/jaba.1994.27-197

[9]. Lang, R., O'Reilly, M., Healy, O., Rispoli, M., Lydon, H., Streusand, W., ... & Giesbers, S. (2012). Sensory integration therapy for autism spectrum disorders: A systematic review. Research in Autism Spectrum Disorders, 6(3), 1004–1018. https://doi.org/10.1016/j.rasd.2012.01.006

[10]. Leekam, S. R., Nieto, C., Libby, S. J., Wing, L., & Gould, J. (2007). Describing the sensory abnormalities of children and adults with autism. Journal of Autism and Developmental Disorders, 37(5), 894–910. https://doi.org/10.1007/s10803-006-0218-7

[11]. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. Systematic Reviews, 10(1), Article 89. https://doi.org/10.1186/s13643-021-01626-4