Literature Review Study: Gymnastics as an Approach to Improving Gross Motor Skills in Children with Autism Spectrum Disorder (ASD)

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Abstract

Children with Autism Spectrum Disorder (ASD) exhibit distinctive characteristics such as impaired sensory processing, difficulties in motor coordination, and stereotyped behaviors. Motor coordination impairments caused by vestibular and neuroceptive dysfunctions often result in lower motor skills compared to typically developing children, leading to reduced independence and reliance on others. Therefore, providing motor skill training is essential to support their overall development. Rhythmic gymnastics offers various benefits for children with diverse characteristics and can be easily implemented in school settings, making it a popular subject of study and development. This article reviews previous research on rhythmic gymnastics for children with ASD through a systematic literature review method. Overall, the findings indicate that rhythmic gymnastics combined with music can effectively enhance the motor skills of children with ASD.

Keywords: Autism Spectrum Disorder, Rhythmic Gymnastics, Gross Motor Skills ASD

Introduction

Autism Spectrum Disorder (ASD) is a complex developmental disorder, with symptoms typically emerging within the first three years of a child's life. This condition is caused by neurological factors that affect brain function, resulting in various developmental impairments. According to the classification established by the American Psychiatric Association, ASD is categorized as a spectrum disorder that encompasses a wide range of symptoms and severity levels. Children with ASD exhibit distinctive characteristics, including sensory processing difficulties, motor coordination impairments, and stereotyped behaviors. They also face challenges in communication and social interaction. These characteristics vary among individuals but generally reflect how they interact with their surroundings and the people around them (American Psychiatric Association, 2013).

Motor development in children begins with gross motor skills before fine motor skills. For instance, a child learns to grasp large objects before handling smaller ones (Farida, 2016). Motor skills play a crucial role in physical activities and in enhancing the abilities required for daily life tasks (Reagan et al., 2022). Impaired motor coordination caused by vestibular and neuroceptive dysfunctions in children with ASD results in relatively low motor skill levels compared to typically developing children, making them less independent and reliant on others (Bina, 2014). More than 80% of children with ASD experience motor deficits, including difficulties in hand/head coordination, motor planning, balance, and interpersonal

movement synchronization (Srinivasan et al., 2015). Research conducted by Hayley Leonard, Rachael Bedford, Andrew Pickles, and Catherine Lord (2015) on motor skills in children with ASD indicates a significant correlation between early motor abilities and later motor development. This finding suggests that a child's early motor competence can influence subsequent developmental progress (Leonard et al., 2015). Therefore, it is essential to provide motor skill training to support further development. One effective approach to improving gross motor skills in children with ASD is through rhythmic gymnastics.

Rhythmic gymnastics, characterized by its integration of physical movement and musical rhythm, plays a pivotal role in enhancing developmental skills in children. This discipline's therapeutic aspects are especially relevant for children with Autism Spectrum Disorder (ASD), as music and rhythm can significantly benefit them. The synchronization of movement with rhythmic music promotes physical coordination and fosters emotional and cognitive development, enhancing adaptive behavior and communication skills in children with ASD (Duan et al., 2022), Bharathi et al., 2019).

Research indicates that music therapy, particularly when used in conjunction with physical activities like rhythmic gymnastics, has profound therapeutic effects. Music serves as a fundamental tool in assistance, providing rhythmic cues that can enhance motor function and coordination (Duan et al., 2022). Studies have demonstrated that engaging children with ASD in rhythmic activities leads to notable improvements in motor skills and communication abilities (Pranjić et al., 2024; , Bharathi et al., 2019). Moreover, music-based interventions have been found to increase social engagement and spontaneous interactions in children, which are crucial aspects of social development for those with autism (Srinivasan et al., 2016; , Kaur et al., 2018).

The beneficial effects of rhythmic gymnastics extend beyond basic motor skills to include enhanced cognitive functions such as attention and working memory. Participants in rhythmic gymnastics programs show improved selective attention alongside their physical capabilities, underscoring the cognitive load that rhythmic coordination entails (Carvalho et al., 2023). Importantly, literature indicates that rhythmic training can help solidify neural pathways associated with rhythm perception and production, which are often underdeveloped in children with ASD (Lense et al., 2021).

Several studies have identified the reasons for selecting rhythmic gymnastics as a suitable physical activity for children with ASD. (1) Gymnastics requires high concentration to master movements, stimulates motor skill development, promotes health, and enhances quality of life (Coelho, 2010). (2) Gymnastics is an aerobic exercise, and strong aerobic capacity positively impacts the cognitive functions of individuals with developmental disabilities (McDaniel et al., 2014). (3) Rhythm is an inherent human behavior; rhythmic gymnastics consists of simple and safe rhythmic movements that are easy to learn and appropriate for children with varying abilities. This activity can improve the motor skills and self-confidence of children with ASD (Van de Vliet et al., 2004). (4) Special education schools generally require simple and applicable learning instruments, including in rhythmic gymnastics learning (Duan et al., 2022).

Given its numerous benefits and ease of implementation in school settings, rhythmic gymnastics has become a frequent subject of educational and developmental research. Therefore, this study is considered significant in identifying appropriate adaptive learning programs to enhance gross motor skills in children with ASD, particularly through rhythmic gymnastics.

Method

This study was conducted using a literature review method. The search strategy involved identifying relevant articles through Google Scholar and other academic publication databases, covering the period from 2018 to 2024. The keywords used in the search included *"gross motor skills," "motor skills ASD,"* and *"rhythmic gymnastics for ASD."* The initial search using these keywords yielded approximately 6,500 related articles. The authors then conducted a screening process to identify studies that were accessible in full-text

format and relevant to the research focus, resulting in 120 eligible articles. A further screening and eligibility assessment were carried out based on inclusion and exclusion criteria related to the research topic. After a detailed review process, seven articles were selected as the primary sources for this study, focusing specifically on the use of rhythmic gymnastics as an intervention to improve gross motor skills in children with Autism Spectrum Disorder (ASD).

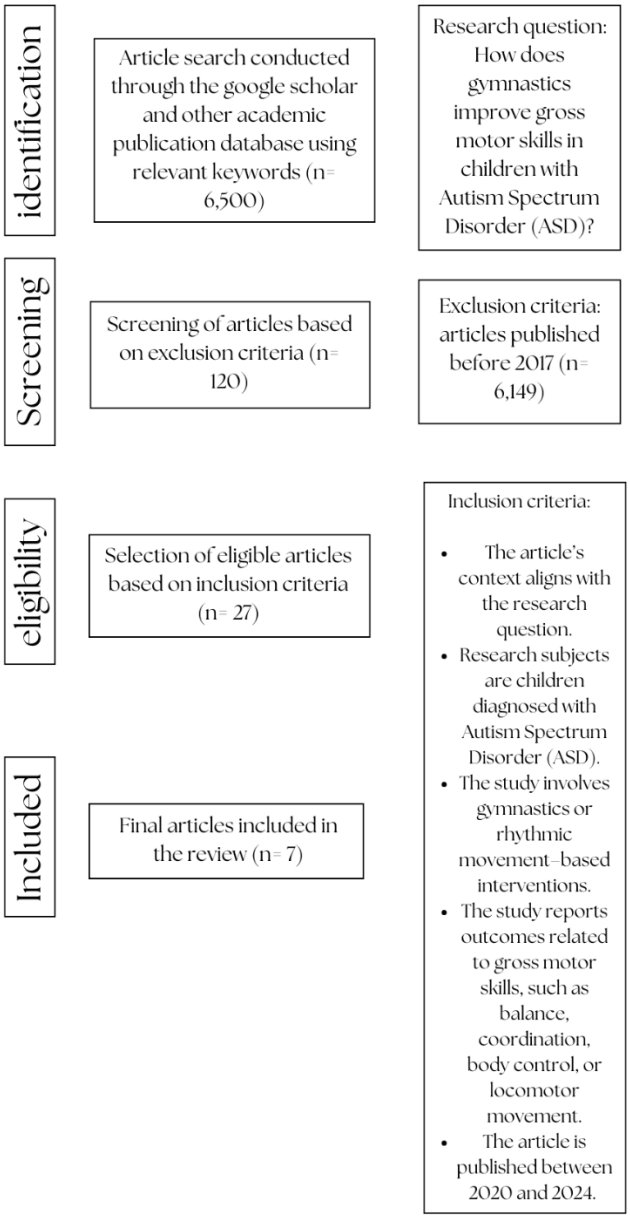

Figure 1. PRISMA Flowchart

Result

The articles discussed in this review are based on international publications. The results of the analysis of these research articles are presented in the following table:

Table 1. Analysis Results

Article Title	Year	Researchers	Method and Sample	Research Findings
Dance, Rhythm, and Autism Spectrum Disorder: An Exploratife Study	2021	Phoebe O. Morris; Edward Hope; Tom Foulsham; John P. Mills.	Mixed-method approach (qualitative and quantitative) involving a sample of 553 dance therapists in the United States.	The study revealed that therapists incorporated music and rhythm into therapeutic interventions for children with ASD. The musical elements in rhythmic gymnastics were found to enhance not only gross motor skills but also the communication and social skills of children with ASD (Reagan et al., 2021).
Effectiveness of Physical Therapy and/or Music Therapy on Enhancing Motor Skills in Children with Autism Spectrum Disorder	2022	Julia Reagan; Lauren Zoller; Michell e Brown.	Systematic Review	The study indicated that rhythmic movements combined with music effectively improved gross motor skills and enhanced neural connectivity within specific regions of the brain (Reagan et al., 2022).
Effect of Rhythmic Gymnastics on Joint Attention and Emotional Problems of Autistic Children: A Preliminary Investigation	2022	Guantin g Duan; Qing Han; Mingya n Yao; Ran Li.	Quantitative method using a multiple baseline A-B-A design with two participants—children with ASD aged six years.	The findings demonstrated that rhythmic gymnastics not only increased attention and emotional regulation in children with ASD but also positively influenced their gross motor coordination (Duan et al., 2022).
The Effects of a Play-based Intervention on Imitation-based Rhythmic Durmming Performance in Children with Autism Spectrum Disorder	2021	Pranati Mathur	Experimental pretest–posttest design with a sample of children with ASD aged 6–12 years.	The research identified rhythmic activities as suitable interventions for children with ASD, as they promote sensorimotor synchronization, motor coordination, and movement accuracy among autistic children (Mathur, 2021).

Adapted Rhythmic Gymnastics Based on ICF-CY for Children with Low Function Autism Spectrum Disorder	2021	Chen-Chen Xu; Ming- Yan, Yao; Fu-bing;Qi u; Wen, Yu; Yue -shuai JIANG;	Experimental method with three male participants diagnosed with low-functioning ASD (IQ range: 47–53).	The study reported improvements in body structure quality, bodily function, activity, and participation following the intervention. Rhythmic gymnastics adapted to the ICF-CY framework was found to enhance gross motor function in children with low-functioning ASD. The study further recommended rhythmic gymnastics as a potential form of rehabilitative exercise for children with ASD (Xu et al., 2021).
Improving Physical Fitness of Children with Intellectual and Developmental Disabilities trough an Adapted Rhytmic Gymnastics Program in China	2020	Chenche n Xu; Mingya n Yao; Mengxu e Kang;	Experimental design involving two student participants with Intellectual and Developmental Disabilities (IDD).	The research showed statistically significant results ($p = 0.038 < 0.05$) in physical fitness parameters. These findings indicated improvements in gross motor skills, abdominal strength, and overall physical fitness (Xu et al., 2020).
The impact of Auditory Rhythmic Cueing on Gross Motor Skills in Childern with Autism	2018	Samah Attia El Shemy; Moham ed Salah El-Sayed.	Experimenta l method with a sample of 30 children with autism aged 8–10 years.	The study found a statistically significant improvement in coordination, balance, agility, and strength among children after the intervention. Rhythmic activities incorporating auditory stimulation produced positive effects on the gross motor skills of children with autism (El Shemy & El-Sayed, 2018).

Discussion

The review analyzed seven international studies examining the role of rhythmic gymnastics and rhythmic-based interventions in enhancing gross motor skills among children with Autism Spectrum Disorder (ASD).

The first study by Morris et al. (2021) utilized a mixed-method approach involving 553 dance therapists across the United States. The findings revealed that therapists frequently incorporated music and rhythm into therapeutic sessions for children with ASD. Musical elements within rhythmic exercises were found to significantly improve gross motor abilities as well as communication and social interaction skills. This suggests that rhythm-based movement can serve as a holistic intervention, promoting both motor and socio-emotional development.

The second study, conducted by Reagan et al. (2022), employed a systematic review method to explore the combined effects of physical and music therapy. The results indicated that rhythmic movement, when paired with musical accompaniment, effectively enhanced gross motor coordination and stimulated neural connectivity in specific brain regions. This finding reinforces the neurophysiological

benefits of rhythmic training in supporting motor learning and neural integration among children with ASD.

A study by Duan et al. (2022) applied a quantitative A-B-A multiple baseline design involving two children aged six years with ASD. The intervention demonstrated improvements not only in attention and emotional regulation but also in gross motor coordination. This highlights that rhythmic gymnastics can contribute to both behavioral and physical development, providing an integrated approach to therapy.

Similarly, Mathur (2021) conducted an experimental pretest–posttest study with children aged 6–12 years. The results indicated that rhythmic and imitation-based drumming activities effectively improved sensorimotor synchronization, motor coordination, and movement accuracy. These findings suggest that rhythm-based play interventions can support imitation, attention, and movement control—skills often impaired in children with ASD.

Further evidence from Xu et al. (2021) examined three male participants with low-functioning ASD (IQ 47–53) using a rhythmic gymnastics program adapted to the International Classification of Functioning, Children and Youth (ICF-CY) framework. The study reported notable improvements in body structure, functional ability, activity, and participation. The authors recommended rhythmic gymnastics as a suitable rehabilitative intervention for children with lower functional capacities, particularly to enhance gross motor functioning and daily activity participation.

In a related study, Xu et al. (2020) conducted an experimental intervention with two students with Intellectual and Developmental Disabilities (IDD). The analysis revealed statistically significant improvements in gross motor skills, abdominal strength, and overall physical fitness ($p = 0.038 < 0.05$). These results emphasize that rhythmic gymnastics can enhance both motor proficiency and general health outcomes, extending its benefits beyond the ASD population.

Finally, El Shemy and El-Sayed (2018) investigated the effects of auditory rhythmic cueing on 30 children with autism aged 8–10 years. The intervention produced statistically significant improvements in coordination, balance, agility, and muscular strength. This finding supports the use of auditory rhythm as an external cue to facilitate motor synchronization and coordination among children with ASD.

Collectively, the reviewed studies demonstrate that rhythmic gymnastics and rhythm-based activities play a significant role in enhancing gross motor skills in children with ASD. Beyond physical benefits, these interventions also foster improvements in communication, social interaction, emotional regulation, and neural connectivity. The multisensory stimulation provided through rhythmic movement and music helps mitigate vestibular and neuroceptive challenges that commonly affect motor performance in children with ASD.

Given these outcomes, rhythmic gymnastics can be considered an effective and holistic therapeutic approach for improving gross motor abilities in children with ASD. The reviewed studies also emphasize the importance of adapting rhythmic gymnastics programs to the individual needs and functional levels of each child. Effective implementation requires collaboration among therapists, teachers, and parents to ensure consistent practice and developmental support.

Future research should involve larger and more diverse samples, as well as longitudinal designs, to validate the long-term effects of rhythmic gymnastics on gross motor development and its potential integration into structured educational and therapeutic programs for children with ASD.

Conclusion

Based on the review of seven international studies, rhythmic gymnastics and rhythm-based interventions have proven effective in enhancing gross motor skills among children with Autism Spectrum Disorder (ASD). These activities not only improve physical abilities such as coordination, balance, strength, and motor accuracy, but also contribute to broader developmental areas including communication, social

interaction, emotional regulation, and neural connectivity. The integration of rhythmic movement and music provides multisensory stimulation that supports motor learning and mitigates sensory processing challenges commonly experienced by children with ASD. Therefore, rhythmic gymnastics can be considered a holistic and adaptable therapeutic approach that promotes both physical and socio-emotional development. To strengthen the evidence base, future research should employ larger sample sizes, diverse participant groups, and longitudinal methods to examine the long-term benefits and applicability of rhythmic gymnastics within educational and therapeutic settings.

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