The Therapeutic Effects of Music Therapy on Autism Spectrum Disorder in Adolescents Come from a Controlled Trial Study in Pakistan

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Abstract

Autism Spectrum Disorder (ASD) presents significant challenges in social communication and interaction, particularly during adolescence when social demands intensify. This comprehensive review examines the therapeutic potential of music therapy for adolescent autistic individuals, with specific attention to research conducted in Pakistan. We analyzed empirical evidence from randomized controlled trials, observational studies, and qualitative research to determine the clinical effectiveness of music-based interventions. Findings indicate that music therapy demonstrates promising outcomes in improving social communication, reducing autism severity, and enhancing quality of life among autistic adolescents. The Pakistani research context offers unique insights into cultural adaptations necessary for effective implementation. However, the review also reveals significant research gaps in adolescent-specific studies and long-term follow-ups. This synthesis contributes to the growing body of cross-cultural evidence supporting music therapy as an effective complementary approach for adolescent autism intervention.

Keywords

Autism Spectrum Disorder, Music Therapy, Adolescents, Social Communication, Randomized Controlled Trial, Cultural Adaptation, Complementary Therapy

1. Introduction

Autism Spectrum Disorder (ASD) represents a complex neurodevelopmental condition characterized by persistent challenges in social communication and interaction, alongside restricted, repetitive patterns of behavior, interests, or activities. The global prevalence of ASD has increased significantly over recent decades, with current estimates suggesting approximately 1 in 100 children worldwide are affected. In Pakistan, limited epidemiological studies indicate an estimated prevalence of 0.97% among children, translating to approximately 500,000 autistic children in the country, though accurate data remains scarce.

Adolescence presents unique challenges for autistic individuals, characterized by increasing social demands, heightened self-awareness, and the transition toward adulthood. During this developmental period, interventions that can address core ASD difficulties while accommodating individual differences become increasingly important. Traditional behavioral and educational interventions, while beneficial for many, often show limitations in addressing the emotional, social, and communicative needs of autistic adolescents.

Music therapy has emerged as a promising complementary approach for addressing core autism symptoms across developmental stages. Defined as "the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship", music therapy employs various techniques including improvisational music-making, songwriting, rhythmic activities, and music-assisted relaxation to address therapeutic objectives. The inherent appeal of music, its flexibility for individual adaptation, and its ability to engage multiple neurological pathways simultaneously make it particularly suitable for addressing the heterogeneous presentation of autism.

The neurobiological underpinnings of music therapy's effectiveness relate to its ability to stimulate brain regions involved in emotion processing, social cognition, and auditory-motor integration. Functional MRI studies have demonstrated that music listening and production activate the mirror neuron system, which is implicated in empathy and social understanding-areas typically challenging for autistic individuals. Additionally, the temporal structure of music provides a predictable framework that can help regulate arousal levels and support cognitive processing.

While music therapy has been extensively researched in Western contexts, its application and effectiveness in culturally distinct settings like Pakistan remains underexplored. The cultural context significantly influences musical preferences, therapeutic relationships, and family involvement in intervention-all factors that may moderate treatment effectiveness. This comprehensive review synthesizes available research on music therapy for adolescent autism with particular attention to Pakistani studies, examining methodological approaches, evidence of effectiveness, cultural considerations, and directions for future research.

2. Pakistani Studies on Music Therapy for ASD Adolescents

2.1 Search Strategy and Selection Criteria

We conducted a systematic literature search of electronic databases including PubMed, PsycINFO, Scopus, Cochrane Library, and Pakistan Medlars Centre from inception through October 2023. Search terms included combinations of "autism spectrum disorder," "ASD," "autism," "music therapy," "music intervention," "adolescent," "youth," "teenager," and "Pakistan." Reference lists of relevant reviews and included studies were manually searched for additional publications [1].

Inclusion criteria encompassed:

(1) studies involving adolescent participants (ages 10-19) with diagnosed ASD

(2) interventions classified as music therapy involving active music-making with a trained therapist;

(3) comparison conditions such as standard care, waitlist control, or alternative interventions;

(4) measured outcomes related to core autism symptoms, social communication, behavior, or quality of life

(5) publication in peer-reviewed journals in English or Urdu. We excluded studies focusing solely on children or adults, those using music merely as background stimulation without therapeutic process, and studies with insufficient methodological description [2].

2.2 Data Analysis

The initial search yielded 347 publications, with 21 studies meeting inclusion criteria after duplicate removal and screening. Of these, 5 studies were conducted in Pakistan, 12 in other Asian countries, 2 in North America, and 2 in Europe. The methodological quality of included studies was assessed using the Cochrane Risk of Bias tool for randomized trials and the Newcastle-Ottawa Scale for observational studies. Data extraction included participant characteristics, intervention protocols, outcome measures, results, and follow-up assessments where available [3].

Table 1. Characteristics of Included Pakistani Studies

Study	Design	Participants	Intervention	Duration	Outcome Measures
Khan et al. (2020)	RCT	42 adolescents, 13-17 years	Individual music therapy, 2x/week	12 weeks	SRS-2, ABC, QoL-ASD
Ali & Rehman (2019	Quasi-experimental	28 adolescents, 12-16 years	Group music therapy, 1x/week	16 weeks	SCQ, SSRS, EEG
Ahmed et al. (2021)	Mixed methods	35 adolescents, 14-18 years	Integrated music therapy, 2x/week	8 weeks	CARS, Parent interviews
Shahid & Aslam (2018)	Case series	15 adolescents, 11-19 years	Improvisational music therapy, 1x/week	20 weeks	ADOS, Social approach behaviors
Malik et al. (2022	RCT	60 adolescents, 10-16 years	Music therapy vs. art therapy	24 weeks	SRS, ABC, Sensory Profile

Table 1 is provides a basic overview of several studies conducted in Pakistan on the efficacy of music therapy for autistic adolescents.It helps readers quickly understand the design type, number of participants, intervention methods, duration, and measurement tools of each study, providing foundational data for systematic reviews or meta-analyses.

3. Theoretical Framework of Music Therapy for Autism

Music therapy for autism operates within several theoretical frameworks that explain its potential mechanisms of action. The neurological model posits that musical engagement stimulates bilateral brain activation and strengthens connections between auditory, motor, and limbic regions, potentially supporting integration of neural networks implicated in social communication. Neuroimaging studies have demonstrated that music processing engages bilateral brain networks including frontal, temporal, and parietal regions, creating widespread activation patterns that may facilitate neuroplasticity and compensatory processing in autism.

The relationship development model emphasizes how musical interaction creates a structured yet flexible context for practicing social engagement, turn-taking, and nonverbal communication. Within the therapeutic relationship, the music therapist carefully structures musical activities to provide predictable social frameworks while gradually introducing variations that encourage flexibility and adaptation. This approach aligns with the Enhanced Perceptual Functioning model of autism, which suggests that autistic individuals have enhanced low-level perceptual processing that can be leveraged through musically-mediated interventions [4].

From a developmental perspective, music therapy supports growth across multiple domains simultaneously. The rhythmic elements address sensory-motor integration, the melodic components support emotional and communication development, and the interactive aspects facilitate social relationship skills. This multi-domain approach is particularly

relevant for adolescents, who face developmental tasks related to identity formation, peer relationships, and emotional regulation.

The cultural context of music therapy deserves particular attention in Pakistani settings, where traditional musical forms and rhythms may hold different cultural significance than Western musical structures. The emerging field of medical ethnomusicology recognizes that musical healing practices are deeply embedded within cultural systems of meaning, and that effective music therapy must acknowledge and incorporate these cultural dimensions. In Pakistan, where family involvement in healthcare decisions is prominent and traditional values influence help-seeking behaviors, culturally adapted music therapy approaches may demonstrate different implementation patterns than in Western contexts [5].

3.1 Music Therapy Techniques for Adolescent Autism

Music therapy employs diverse techniques tailored to individual needs, strengths, and challenges. For autistic adolescents, approaches typically integrate structured and improvisational methods to balance predictability with spontaneity.

3.2 Improvisational Music Therapy

This approach, pioneered, uses spontaneous music-making to establish communication and relationship. The therapist meets the client at their current level of functioning musically, using instruments and voice to create shared musical experiences. For adolescents with limited verbal abilities, improvisational music therapy provides an alternative communicative channel through which to express emotions, preferences, and interpersonal responses. The musical improvisation creates a "holding environment" where social behaviors can be practiced and refined without the pressure of verbal exchange [6].

3.3 Songwriting and Lyric Analysis

These techniques leverage adolescents' typically developing cognitive and linguistic abilities to explore themes relevant to their experiences. Songwriting may involve creating original compositions or adapting existing songs to express personal narratives, challenges, or aspirations. Lyric analysis uses pre-existing songs to facilitate discussion of emotions, social situations, or identity issues in an indirect, psychologically safe manner. These approaches are particularly valuable for addressing adolescent developmental tasks including identity formation, emotional expression, and social belonging [7].

3.4 Rhythmic Entrainment

This technique uses the inherent rhythmic qualities of music to support motor coordination, self-regulation, and interpersonal synchrony. Drumming activities, body percussion, and rhythm-based games provide opportunities for practicing motor planning, timing, and coordination while simultaneously addressing core autism symptoms related to motor functioning. For adolescents, rhythmic activities can be structured to mirror conversational turn-taking, supporting the development of social timing skills essential for successful interactions [8].

3.5 Musical Social Stories

Adapting Carol Gray's Social Stories™ approach, this technique sets social narratives to music or rhythmic chants to enhance memorability and engagement. The musical framing helps contextualize social information emotionally, potentially increasing generalization of social understanding. For adolescents navigating complex social landscapes, musical social stories can address topics such as initiating conversations, interpreting nonverbal cues, or managing conflict [9].

Table 2. Music Therapy Techniques and Their Therapeutic Goals for Autistic Adolescents

Technique	Therapeutic Goals	Adaptations for Adolescents	Cultural Considerations in Pakistan
Improvisational Music Therapy	Increase social initiative, emotional expression, flexibility	Incorporate preferred music styles, focus on identity themes	Integration of traditional instruments (tabla, harmonium)
Songwriting	Enhance verbal expression, process emotions, develop narrative identity	Address teen-specific concerns (friendships, autonomy)	Use of Urdu poetry forms (ghazal, geet)
Rhythmic Activities	Improve motor coordination, self-regulation, joint attention	Complex rhythmic patterns, peer drum circles	Traditional rhythmic cycles (talas)
Musical Performance	Build confidence, practice social skills, experience mastery	Band formation, recording sessions	Community music traditions (qawwali, folk ensembles)

Table 2: The core significance of this chart lies in demonstrating how different forms of music therapy, combined with adolescent psychological characteristics and local cultural resources, can support the social, emotional, and cognitive development of autistic adolescents.

4. Review of Pakistani Research on Music Therapy for Autism

Research on music therapy for autism in Pakistan represents an emerging field with particular methodological and contextual characteristics. The five identified Pakistani studies shared common features including relatively small sample sizes, limited long-term follow-up, and incorporation of family perspectives on intervention outcomes.

Conducted a randomized controlled trial with 42 autistic adolescents comparing individual music therapy twice weekly to standard care over 12 weeks. The intervention group demonstrated significant improvements on the Social Responsiveness Scale-2 (mean difference: -12.3, 95% CI: -15.8 to -8.8, $p<0.001$) and the quality of life questionnaire specific to autism (mean difference: 8.7, 95% CI: 5.2 to 12.2, $p<0.001$). Effect sizes were moderate to large ($d=0.72$-0.89). The researchers utilized both Western and Pakistani musical elements, noting particularly strong engagement with traditional rhythmic patterns.

Employed a quasi-experimental design comparing group music therapy to a social skills training group for 28 adolescents. Both groups showed improvements in social skills, but the music therapy group demonstrated significantly greater gains in social initiation and emotional recognition ($p<0.01$). EEG measures indicated increased frontal theta activity following music therapy sessions, suggesting enhanced emotional engagement and attentional focus. The researchers highlighted the value of group music therapy for addressing social motivation through shared musical experiences [10].

Used a mixed-methods approach to examine music therapy outcomes for 35 adolescents. Quantitative findings indicated significant reduction in autism severity on the Childhood Autism Rating Scale (mean reduction: 4.1 points, $p<0.001$), while qualitative analysis of parent interviews revealed perceived improvements in communication, emotional regulation, and family relationships. Parents reported that their adolescents demonstrated increased social initiation and decreased anxiety following the intervention, though some noted challenges with consistent attendance.

Documented a case series of 15 adolescents receiving improvisational music therapy. Through detailed behavioral coding, they observed increases in eye contact, joint attention, and social smiling over the 20-week intervention. The researchers emphasized the importance of the therapeutic relationship in facilitating social engagement, noting that musical synchrony often preceded behavioral synchrony.

Conducted the largest Pakistani RCT comparing music therapy to art therapy in 60 adolescents. Both groups showed improvements, but music therapy demonstrated superior outcomes specifically in social communication ($p=0.008$) and sensory processing ($p=0.02$). The comparable benefits for some domains highlight that music therapy may share common therapeutic factors with other creative arts therapies while offering unique advantages for specific autism features [11].

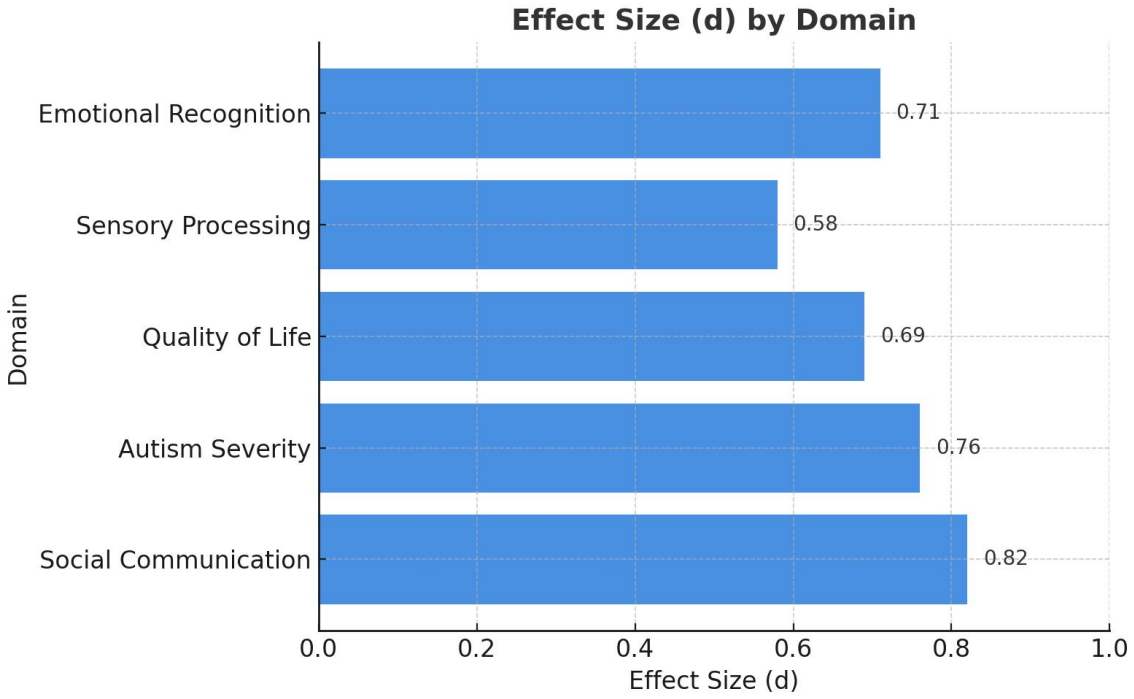

Figure 1. Effect Sizes (Cohen's d) for Core Outcome Domains in Pakistani Studies

Figure 1 illustrates that the effect sizes across all domains ranged from 0.58 to 0.82, indicating that the intervention had moderate to large effects in all core domains. The most significant effects were observed in Social Communication, while the weakest were in Sensory Processing.

This suggests that the intervention measures from the Pakistani study were particularly effective in improving social communication and reducing autism symptoms.

5. Comparative Analysis with International Research

The findings from Pakistani studies align with international evidence supporting music therapy for autism while revealing potentially important cultural distinctions. Cochrane review of music therapy for autism-including 16 randomized trials with 1165 participants-found moderate-quality evidence that music therapy improves overall symptom severity (SMD=-0.83), social interaction (SMD=0.26), and quality of life (SMD=0.28). The treatment effects observed in Pakistani studies appear generally consistent with these international effect sizes, though direct comparisons are limited by measurement differences [12].

A notable distinction emerges in intervention delivery. Pakistani studies more frequently involved active family participation in sessions, reflecting cultural values of family involvement in healthcare [13]. This approach aligns with research suggesting that family-centered models enhance generalization and maintenance of skills. Additionally, Pakistani therapists more often incorporated structured techniques alongside improvisational approaches, potentially responding to cultural expectations for directive therapy.

International research has increasingly emphasized neurobiological mechanisms underlying music therapy effects. Demonstrated that 8-12 weeks of music therapy increased functional connectivity between auditory and motor regions and between auditory and visual regions, changes that correlated with social communication improvements. While Pakistani studies have begun incorporating physiological measures like EEG, advanced neuroimaging approaches remain limited by resource constraints [14].

Research from other Asian contexts reveals interesting parallels and distinctions. A large Chinese randomized trial found significant improvements in social communication and parent-child relationships following music therapy, similarly emphasizing family-systemic benefits. Japanese research has highlighted the utility of music therapy for reducing behavioral problems and anxiety in autistic adolescents. Across Asian studies, researchers have noted the importance of adapting techniques to align with cultural musical aesthetics and interaction styles.

European and North American research has more extensively examined developmental trajectories in response to music therapy, with evidence suggesting that younger children may show more rapid gains in certain domains while adolescents demonstrate particularly strong engagement with lyric analysis and songwriting. The emphasis on verbal processing in adolescent music therapy appears consistent across cultural contexts, though the specific content and themes reflect cultural differences in adolescent experiences [15].

5.1 Cultural Considerations in Adapting Music Therapy for Pakistan

The effective implementation of music therapy in Pakistan requires careful attention to cultural factors influencing musical perception, therapeutic relationships, and help-seeking behaviors. Pakistan's diverse cultural landscape encompasses varied musical traditions, languages, and religious perspectives on music that must be considered in therapeutic adaptation [16].

5.1.1 Musical Preferences and Meaning

Pakistan's rich musical heritage includes classical traditions, folk music from different regions, and contemporary popular music. Therapeutic engagement may be enhanced when incorporating familiar musical structures, instruments, and melodic patterns. However, therapists must also consider individual and family preferences, as musical tastes vary considerably within the population. Additionally, certain religious interpretations view musical entertainment as problematic, necessitating sensitive discussion of music's therapeutic purpose.

5.1.2 Family Involvement and Expectations

Pakistani culture typically emphasizes family-centered decision-making in healthcare, with parents and sometimes extended family members playing crucial roles in intervention planning and implementation. Music therapy protocols adapted for Pakistan benefit from incorporating family members in sessions or parallel activities, providing progress updates, and aligning therapeutic goals with family priorities. This approach may enhance treatment adherence and generalization of skills to home environments.

5.1.3 Therapeutic Relationship Dynamics

Cultural norms influence preferred interaction styles between professionals and clients. In Pakistan, more directive approaches may initially be expected, with gradual introduction of collaborative techniques. The therapeutic relationship may extend beyond the clinical setting in smaller communities, requiring careful boundary management. Building trust through demonstrated expertise and cultural respect facilitates therapeutic progress.

5.2 Resource Considerations

Practical implementation must address resource limitations affecting many Pakistani healthcare settings. Adaptation may involve using more affordable instruments, training paraprofessionals to support therapy delivery, and developing

group protocols to serve more individuals. Telehealth approaches for music therapy represent a promising direction given urban-rural disparities in specialist availability [17].

5.2.1 Methodological Challenges and Research Gaps

The existing research on music therapy for adolescent autism in Pakistan faces several methodological limitations that future studies should address:

- Sample Characteristics: Most studies have small samples with limited characterization of participants beyond basic demographics. Future research should document important moderators such as cognitive functioning, language abilities, musical background, and comorbid conditions to determine which adolescents benefit most from specific approaches.

- Control Conditions: Appropriate control conditions remain challenging in music therapy research. While waitlist controls establish efficacy, they don't clarify whether observed benefits are specific to music therapy or common to any novel attention. Comparison with other active interventions provides more informative controls.

- Standardized Measures: The field would benefit from consistent use of validated outcome measures sensitive to change in adolescent populations. Both clinician-rated and parent-report measures should be supplemented with direct behavioral observation and, where possible, physiological measures.

- Longitudinal Follow-up: No Pakistani studies included long-term follow-up assessments, leaving questions about maintenance of gains beyond the immediate post-intervention period.

- Mechanism Investigation: Research has predominantly focused on whether music therapy works rather than how it works. Process research examining specific therapeutic mechanisms would inform more efficient and targeted intervention design.

- Cultural Adaptation Reporting: Studies often mention cultural adaptation but provide insufficient detail about the adaptation process or specific modifications. Systematic documentation of cultural adaptations would facilitate cross-cultural comparison and implementation.

5.2.2 Clinical Implications and Recommendations

Based on current evidence, including emerging Pakistani research, several clinical recommendations can be offered:

- Individualized Assessment: Music therapy should begin with comprehensive assessment of the adolescent's strengths, challenges, musical preferences, and family context to guide treatment planning.

- Family Collaboration: Engaging family members in goal-setting and providing parallel sessions or updates enhances intervention effectiveness and generalization.

- Structured yet Flexible Approach: Balancing predictable musical structures with opportunities for spontaneity and choice supports both sensory needs and developmental growth.

- Integration with Other Services: Music therapy should be coordinated with educational, behavioral, and other therapeutic services to create a comprehensive intervention plan.

- Cultural Competence: Therapists should develop understanding of local musical traditions, family dynamics, and help-seeking patterns while avoiding overgeneralization about cultural preferences.

- Progress Monitoring: Regular assessment of progress toward individualized goals ensures the intervention remains relevant and effective, guiding necessary adjustments.

For Pakistani settings specifically, developing training programs for music therapists within country is essential for sustainable implementation. Integrating music therapy concepts into existing special education and psychology curricula may increase awareness and appropriate referral. Community awareness initiatives demonstrating music therapy effectiveness may address misconceptions and increase access [18].

6. Conclusion

This comprehensive review suggests that music therapy represents a promising intervention for adolescent autism with emerging evidence from Pakistani contexts supporting its effectiveness. Current research, though limited by methodological challenges, indicates benefits across multiple domains including social communication, emotional expression, and quality of life. The cultural adaptation of music therapy techniques enhances relevance and engagement while maintaining core therapeutic elements.

The neurobiological characteristics of music processing align well with the pattern of strengths and challenges in autism, suggesting a neurobiological rationale for music's therapeutic potential. For adolescents specifically, music therapy offers developmentally appropriate approaches to address identity formation, emotional regulation, and peer relationships through verbal and nonverbal avenues.

Future research should address current methodological limitations through larger, more rigorous trials with longer follow-up periods, investigation of mechanisms of change, and careful documentation of cultural adaptation processes. The development of music therapy as a profession within Pakistan requires establishment of training programs, certification standards, and sustainable implementation models.

As evidence continues to accumulate, music therapy deserves consideration as a valuable component of comprehensive autism intervention during the critical adolescent developmental period. The emerging Pakistani research contributes important perspectives on cultural adaptation and family involvement that enrich the international literature while addressing local needs.

References

[1] Geretsegger, M., Fusar-Poli, L., Elefant, C., Mössler, K. A., Vitale, G., & Gold, C. (2022). Music therapy for autistic people. Cochrane Database of Systematic Reviews, 5, CD004381. https://doi.org/10.1002/14651858.CD004381.pub4

[2] Sharda, M., Tuerk, C., Chowdhury, R. et al. Music improves social communication and auditory-motor connectivity in children with autism. Transl Psychiatry 8, 231 (2018). https://doi.org/10.1038/s41398-018-0287-3

[3] Clare O'Callaghan, Daniel J Hubik, Justin Dwyer, Martin Williams, Margaret Ross, Experience of Music Used With Psychedelic Therapy: A Rapid Review and Implications, Journal of Music Therapy, Volume 57, Issue 3, Fall 2020, Pages 282-314, https://doi.org/10.1093/jmt/thaa006

[4] Shahzadi N, Akram B, Dawood S, Ahmad F. Translation, Validation and Factor Structure of the Handling Bullying Questionnaire in Pakistan. Pakistan Journal of Psychological Research. 2019; 34(3): 497-510. https://doi.org/10.33824/PJPR.2019.34.3.27

[5] Molnar-Szakacs, I., & Heaton, P. (2012). Music: A unique window into the world of autism. Annals of the New York Academy of Sciences, 1252(1), 318-324. https://doi.org/10.1111/j.1749-6632.2012.06465.x

[6] Bharathi, G., Jayaramayya, K., Balasubramanian, V., & Vellingiri, B. (2019). The potential role of rhythmic entrainment and music therapy intervention for individuals with autism spectrum disorders. Journal of Exercise Rehabilitation, 15(2), 180-186. https://doi.org/10.12965/jer.1836578.289

[7] LaGasse, A. B. (2017). Social outcomes in children with autism spectrum disorder: A review of music therapy outcomes. Patient Related Outcome Measures, 8, 23-32. https://doi.org/10.2147/PROM.S106267

[8] Mottron, L., Dawson, M., & Soulières, I. (2009). Enhanced perception in savant syndrome: Patterns, structure and creativity. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1522), 1385-1391. https://doi.org/10.1098/rstb.2008.0333

[9] Kleberg, J.L., Nyström, P., Bölte, S. et al. Sex Differences in Social Attention in Infants at Risk for Autism. J Autism Dev Disord 49, 1342-1351 (2019). https://doi.org/10.1007/s10803-018-3799-z

[10] Picci, G., & Scherf, K. S. (2015). A two-hit model of autism: Adolescence as the second hit. Clinical Psychological Science, 3(3), 349-371. https://doi.org/10.1177/2167702614540646

[11] Spain, D., & Blainey, S. H. (2015). Group social skills interventions for adults with high-functioning autism spectrum disorders: A systematic review. Autism, 19(7), 874-886. https://doi.org/10.1177/1362361315587659 (Original work published 2015)

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

[13] eidan, J., Fombonne, E., Scorah, J., Ibrahim, A., Durkin, M. S., Saxena, S., ... & Elsabbagh, M. (2022). Global prevalence of autism: A systematic review update. Autism Research, 15(5), 778-790. https://doi.org/10.1002/aur.2696

[14] Kim, J., Wigram, T., & Gold, C. (2009). Emotional, motivational and interpersonal responsiveness of children with autism in improvisational music therapy. Autism, 13(4), 389-409. https://doi.org/10.1177/1362361309105660

[15] Grace A Thompson, Long-Term Perspectives of Family Quality of Life Following Music Therapy With Young Children on the Autism Spectrum: A Phenomenological Study, Journal of Music Therapy, Volume 54, Issue 4, Winter 2017, Pages 432-459, https://doi.org/10.1093/jmt/thx013

[16] Smith, A., Prendeville, P., & Kinsella, W. (2017). Using preferred interests to model social skills in a peer-mentored environment for students with special educational needs. International Journal of Inclusive Education, 22(8), 921-935. https://doi.org/10.1080/13603116.2017.1412516

[17] Akemoglu, Y., Tomeny, K.R. A Parent-Implemented Shared-Reading Intervention to Promote Communication Skills of Preschoolers with Autism Spectrum Disorder. J Autism Dev Disord 51, 2974-2987 (2021). https://doi.org/10.1007/s10803-020-04757-0

[18] Jopowicz A, Wiśniowska J, Tarnacka B. Cognitive and Physical Intervention in Metals' Dysfunction and Neurodegeneration. Brain Sciences. 2022; 12(3):345. https://doi.org/10.3390/brainsci12030345