



Research Paper: The Effectiveness of Music Therapy on Behavioral Problems in Children with High-Functioning Autism Spectrum Disorder



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Abstract

Objective: The present study aimed to investigate the effectiveness of music therapy on behavioral problems in children with high-functioning autism spectrum disorder.

Methods: The research method of this study was quasi-experimental using a pre-test-post-test design with a control group. The statistical population of the study included high-functioning children with autism spectrum disorder in special schools and counseling centers of Bandar Anzali city during the academic year 2023-2024. A total of 30 individuals were selected using purposive sampling and randomly assigned to two groups: experimental (15 individuals) and control (15 individuals). The Achenbach Child Behavior Checklist (CBCL) was used for both groups. The experimental group received ten 45-minute sessions of music therapy intervention, while the control group received no intervention. After the completion of the therapy sessions, the questionnaire was administered again to both groups. Data were analyzed using analysis of covariance (ANCOVA) statistical method with SPSS-27 software at a significance level of $p < 0.05$.

Results: The results showed that music therapy is effective in improving behavioral problems of high-functioning children with autism spectrum disorder ($p < 0.05$).

Conclusion: Therefore, it can be concluded that music therapy can be used to improve behavioral problems of high-functioning children with autism spectrum disorder in schools or rehabilitation centers.

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1. Introduction

Autism spectrum disorders are a range of neurodevelopmental disorders characterized by persistent deficits in social communication and interaction across multiple contexts, as well as restricted, repetitive patterns of behavior, interests, or activities. This phenotype encompasses a wide range of symptoms in various domains, including cognitive, behavioral, emotional, and sensory symptoms (American Psychiatric Association, 2022). Furthermore, sleep and eating problems, synesthesia, as well as emotional disorders and difficulties in initiation, planning, and organization are often present in autism spectrum disorder (Wiggins et al., 2015). The prevalence of this disorder among 4-year-old children is estimated to be approximately 13.4 per 1000 (Christensen et al., 2019). Additionally, children with autism spectrum disorder have a significant weakness in predicting the behavior of others. Therefore, it is predictable that these children will exhibit impairments in social skills (Barendse et al., 2018).

The occurrence of stereotyped behaviors is one of the main diagnostic criteria in individuals with autism spectrum disorder. These behaviors often refer to repetitive interests and motor or verbal sequences (Babadi et al., 2016). In terms of repetitive and maladaptive behaviors, children with autism spectrum disorder exhibit behaviors such as repetitive spinning of toys, stereotyped behaviors including repetitive body movements like hand flapping and finger flicking, as well as negative behaviors such as self-injurious, aggressive, and

defensive behaviors, which appear to be performed in response to sensory stimulation (Sharma, 2018).

In recent decades, the behavioral issues and problems of children have been a significant topic in the literature of psychology, psychiatry, and education. These problems are reported to be considerably more prevalent in children with autism than in typically developing children. The rate of undesirable emotional reactions and behavioral problems in individuals with intellectual disabilities is four to five times higher than in typically developing individuals (Hulsmans et al., 2021; Harris et al., 2018). Therefore, the socio-emotional problems of children and adolescents with autism are of great importance (Geiger et al., 2020). Behavioral problems refer to patterns of behavior that impair the healthy relationship between the child, the environment, and learning opportunities. Some researchers consider behavioral problems to include internalizing problems such as withdrawal, depression, and anxiety, and externalizing problems such as aggression, hyperactivity, and defiance (Aghayinejad et al., 2021). Behavioral problems in the early years place a child's life on an unfavorable developmental path and, in addition to disrupting the child's abilities, make them susceptible to other problems in the future, including delinquency in adolescence and criminal and aggressive behavior in adulthood (Kakabraee & Emami Ale Agha, 2018). For this reason, timely intervention for behavioral problems in children is of particular importance (Kiani & Aleyasin, 2025).

Principles of managing child behavior with developmental concerns include early intervention and response to treatment, modification, and, if necessary, specific behavioral and pharmacological interventions. To this end, numerous non-pharmacological interventional therapies exist based on engaging children and parents in reducing behavioral problems in children with autism spectrum disorders (Pournesai et al., 2025); one such interventional method is Music therapy based on rhythmic activities. Music therapy, with elements such as melody, harmony, and rhythm, provides multidimensional stimuli that can lead to cognitive function (Barbaroux et al., 2019). Researchers believe that many problems in autistic children stem from a dysfunction of mirror neurons, and music therapy can reduce problems in autistic children by activating the brain's mirror neurons (Catherine et al., 2010). The American Music Therapy Association (2019) also defines music as a treatment for mental, emotional, cognitive, and spiritual needs. Music activities can serve as reinforcers in creating reciprocal and conscious responses in children with autism spectrum disorder, such as increased speech, improved social and communication skills, the generation of verbal responses, and increased eye contact. In this form of movement, sensorimotor abilities, such as balance, coordination, understanding spatial and temporal relationships, and the orientation of the whole or different parts of the body, are actively involved. Furthermore, in rhythmic movements accompanied by music and the presentation of stimuli and responses, there is a kind of order and

sequence that requires the child to provide timely, quick, and relevant responses to stimuli, which can be effective in improving many deficits resulting from motor learning difficulties (Arjmandnia et al., 2021). On the other hand, music is recognized as an important factor in improving behavioral problems and mental disorders (Hoseini, 2021).

Several studies have investigated the impact of music-related activities on the psychological and behavioral functioning of children with developmental coordination disorders. Hamidifard et al. (2023) demonstrated in their research that the use of music therapy alongside other treatment methods can be effective in improving the psychological characteristics of children with autism spectrum disorder. Researchers believe that many of the problems of autistic children stem from impaired mirror neuron function, and music therapy can reduce these problems by activating the brain's mirror neurons (Catherine et al., 2010). Ruutel et al. (2014) found in a study that music therapy is effective in reducing anxiety in individuals with autism spectrum disorder.

Autism spectrum disorder, with a relatively high prevalence, is among the developmental disorders associated with impairments in social functioning, and its symptoms are detectable before the age of three (Hamidifard et al., 2023). On the other hand, through learning and implementing simple, effective, and affordable interventions, especially in the early years of childhood when the impact of interventions is greater, it is possible to reduce behavioral

problems and improve the quality of life for children with autism and their families. However, considering the available research, fewer studies have examined the effectiveness of music on stereotyped behaviors in children with autism. Therefore, it seems that more research is needed in this area. In this regard, the aim of the present study is to investigate the effectiveness of music therapy on the behavioral problems of high-functioning children with autism.

2. Methods

2.1. Research Design and Participants

The research method of this study was quasi-experimental using a pre-test-post-test control group design. The statistical population of the study included high-functioning children with autism spectrum disorder in special education schools and counseling centers of Bandar Anzali city during the academic year 2023-2024. Since a minimum of fifteen individuals per group is recommended in experimental methods (Delavar, 2022), a total of 30 individuals were selected using purposive sampling and randomly assigned to two groups: an experimental group (15 individuals) and a control group (15 individuals). The inclusion criteria for the study were: receiving a diagnosis of high-functioning autism spectrum disorder from a psychiatrist and specialist, agreement and signing of a written consent form by the parents of the child with autism spectrum disorder to participate in the study, children aged between 7 and 14 years, and no comorbidity with other neurodevelopmental disorders such as intellectual disability, hyperactivity, or learning disorders. The exclusion criteria

from the study were: having prior experience participating in music therapy sessions before entering the study; having a very severe form of autism spectrum disorder to the extent that they are unable to perform the minimum exercises of the music therapy sessions; lack of cooperation or absence in 3 consecutive sessions; the child's age being less than 7 years or older than 14 years; and comorbidity with other neurodevelopmental disorders such as intellectual disability, hyperactivity, or learning disorders.

2.2. Instrument

Child Behavior Checklist (CBCL): This checklist was introduced by Achenbach et al. (2001) within the Achenbach System of Empirically Based Assessment to evaluate competence, adaptive functioning, and emotional-behavioral problems of children aged 6-18 years. It includes approximately 118 questions related to behavioral problems that are completed by parents or a person who is responsible for the child's care and upbringing, or anyone who lives with the child in a family-like environment and knows them well. The assessment is based on the child's behavior over the past 6 months and comprises subscales for internalizing behavioral problems, externalizing problems, and total problems. Responses to the Achenbach Child Behavior Checklist questions are in a 3-point Likert scale ranging from 0 to 2. Specifically, a score of '0' is assigned to behaviors that never occur in the child; a score of '1' is given to states and behaviors that are sometimes observed in the child; and a score of '2' is assigned to behaviors that occur most of the time or always in the child's behavior. Internalizing

behavioral problems include the subscales of withdrawn/depressed, somatic complaints, and anxious/depressed. Externalizing behavioral problems include the subscales of rule-breaking behavior and aggressive behavior. In the research by Achenbach et al. (2001), test-retest reliability and internal consistency for emotional-behavioral problems were reported as 0.97 and 0.94, respectively; for externalizing behavioral problems as 0.94 and 0.92; and for internalizing behavioral problems as 0.90 and 0.91. Furthermore, in the standardization of this checklist in the Iranian population by Minaee (2006), the test-retest reliability and internal consistency coefficient for the overall competence scales were 0.79 and 0.58, for emotional-behavioral problems 0.97

and 0.88, for externalizing problems 0.48 and 0.86, and for internalizing problems 0.58 and 0.83. The test-retest reliability coefficient with a time interval of 5 to 8 weeks was obtained in a range of 0.32 to 0.67.

2.3. Music Therapy Program

The music therapy program is derived from a training program presented by Khanjani and Khaknezhad (2016). Music therapy sessions were conducted individually and actively for each child in the experimental group by a coach or child psychologist specializing in music therapy, under the supervision of the relevant supervisor. This program was implemented over 10 sessions, each lasting 45 minutes, for the children.

Table 1

Music Therapy Protocol (Khanjani & Khaknezhad, 2016)

Sessions	Task Description
Session One	Introduction of therapist and subjects, encouraging cooperation, introduction to the two main elements of movement including space and weight, and awareness of the two elements of time and flow.
Session Two	Auditory discrimination training, recognizing and differentiating sounds from each other, and teaching rhythm through the body.
Session Three	Auditory discrimination training, recognizing and differentiating sounds from each other, and teaching rhythm through the body.
Session Four	Auditory discrimination training, auditory comprehension, strengthening auditory memory, and teaching rhythm through body movements.
Session Five	Strengthening auditory association, improving auditory memory, and teaching rhythm and rhythmic perception.
Session Six	Teaching visual perception, strengthening auditory memory and visual accuracy, improving gross motor skills, teaching rhythm, strengthening imitation skills, and practicing body coordination and rhythmic perception.
Session Seven	Supplementary training of gross motor skills and practicing body coordination and rhythmic perception.
Session Eight	Teaching visual perception, practicing eye-hand coordination, especially with the dominant hand, and rhythmic perception.
Session Nine	Strengthening and improving visual perception, supplementary practice of eye-hand coordination, especially with the dominant hand, and rhythmic perception.
Session Ten	Teaching fine motor skills of hands and feet, strengthening visual perception, strengthening eye movement, eye-hand coordination, and rhythmic perception.

2.4. Implementation Method

After obtaining the necessary permits, the researcher visited centers for the care of children with autism in Bandar Anzali city and selected 30 children who met the study's inclusion criteria using purposive sampling. It is worth mentioning that before selecting the sample, the Achenbach Child Behavior Checklist was completed by the children's parents, and the sample was chosen from those who scored higher on this test. Subsequently, two groups (an experimental group and a control group) were formed for the purpose of conducting the research. It is worth noting that both the experimental and control groups were matched in terms of age and gender. The experimental group was exposed to music therapy, while the control group did not receive any intervention. After the therapy sessions were completed, the parents of the children in both groups again completed the Achenbach Child Behavior Checklist. To maintain ethical considerations, informed consent forms were obtained from the children's parents, and they were assured that their information would remain confidential and that the results would be used without mentioning their child's

name. Descriptive and inferential statistical indices were used in this research. In the descriptive statistics section, the mean and standard deviation were initially used to identify relationships between variables. Then, in the inferential statistics section, multivariate analysis of covariance was used to examine the difference in post-test scores. The data were analyzed using SPSS software version 27 at a significance level of 0.05.

3. Results

The research sample consisted of 30 high-functioning children with autism spectrum disorder. The experimental group (music therapy) consisted of 7 boys and 8 girls, and the control group consisted of 8 boys and 7 girls; indicating a relatively homogeneous distribution of gender between the experimental and control groups. The mean age of the experimental group (music therapy) was 10.9 ± 0.78 years, and the mean age of the control group was 10.3 ± 0.71 years, which indicates the homogeneity of the two groups in terms of age. Descriptive statistical indices of the variable under investigation are shown in [Table 2](#).

Table 2

Descriptive Analysis of Behavioral Problems in the Experimental (Music Therapy) and Control Groups

Variable	Phase	Control Group (n=15)	Music Therapy Group (n=15)
Behavioral Problems (Total)	Pre-test	4.80 ± 188.40	5.37 ± 159.27
	Post-test	6.64 ± 152.80	4.51 ± 132.07
Externalizing Behavioral Problems	Pre-test	3.40 ± 52.33	5.38 ± 53.20
	Post-test	6.56 ± 52.73	7.94 ± 42.00
Internalizing Behavioral Problems	Pre-test	2.65 ± 41.86	2.75 ± 41.27
	Post-test	4.55 ± 40.80	5.71 ± 32.27

As Table 2 shows, in the music therapy experimental group, the behavioral problems variable had a mean of 159.27 and a standard deviation of 5.37 in the pre-test phase, and a mean of 132.07 and a standard deviation of 24.51 in the post-test phase. In the music therapy experimental group, the externalizing behavioral problems variable had a mean of 53.20 and a standard deviation of 5.38 in the pre-test phase, and a mean of 42.00 and a standard deviation of 7.94 in the post-test phase. In the music therapy experimental group, the internalizing behavioral problems variable had a mean of 41.27 and a standard deviation of 2.75 in the pre-test phase, and a mean of 32.27 and a standard deviation of 5.71 in the post-test phase.

Subsequently, analysis of covariance (ANCOVA) was used to examine the effectiveness of music therapy on behavioral problems of children with high-functioning autism spectrum disorder. For this purpose, the normality assumption of the distribution of scores for the communication problems variable was examined using the Kolmogorov-Smirnov test, and the Z statistic was not significant at the 0.05 level. This means that the distribution of variables in the sample was normal. Also, Levene's test was used to examine the homogeneity of variances. It was observed that the p-value for the dependent variables in the different measurement phases was greater than 0.05 and not significant. Therefore, the assumption of homogeneity of variances was not violated.

Table 3

Results of the Homogeneity of Variance Test for the Components of the Behavioral Problems Variable

Variable	Levene's Statistic	DF 1	DF 2	Sig
Behavioral Problems	1.59	1	28	0.197
Externalizing Behavioral Problems	2.249	1	28	0.115
Internalizing Behavioral Problems	1.367	1	28	0.266

As the results of Table 3 show, the significance level of the scores for the behavioral problems variable (total) ($F = 1.590$, $P \geq 0.05$) and the components of externalizing behavioral problems ($F = 2.249$, $P \geq 0.05$) and internalizing behavioral problems ($F = 1.367$, $P \geq 0.05$) is greater than the error level of 0.05. Based on this, it can be argued that the assumption of equal variance of the variables in the pre-test and post-test groups is confirmed.

Table 4

Results of the Test for Homogeneity of Regression Slopes of the Research Groups in the Pre-test

Variable	DF	F	Sig
Behavioral Problems	1	1.145	0.326
Externalizing Behavioral Problems	1	1.018	0.355
Internalizing Behavioral Problems	1	1.103	0.311

According to the results of Table 4, the interaction of the pre-test effects with the groups is not significant, indicating that the slope coefficients are homogeneous. This assumption also holds true for the post-test phase (behavioral problems: $F = 1.145$, $P \geq$

0.05; externalizing behavioral problems components: $F = 1.018$, $P \geq 0.05$; and internalizing behavioral problems components: $F = 1.103$, $P \geq 0.05$). Based on this, it can be argued that the assumption of homogeneity of regression slopes is also met.

Table 5

Analysis of Covariance for the Scores of the Behavioral Problems Variable in the Music Therapy Experimental and Control Groups

Stages of the Test	Indicators	Sum of Squares	DF	Mean Square	F	Sig
Post-Test	Group	1356.133	1	848.017	9.948	0.000
	Error	3892.667	28	82.119		
	Total	5548.8	29			

Based on the results of Table 5 for the behavioral problems variable in the post-test phase ($F = 9.948$, $P \leq 0.05$), it can be argued that the difference in the mean scores of this variable between the music therapy experimental and control groups is significant. Accordingly, the hypothesis of a significant difference in the mean of this variable between the music therapy experimental and control groups is confirmed; consequently, music therapy is effective in improving behavioral problems of children with high-functioning autism spectrum disorder ($p \leq 0.05$).

4. Discussion

The aim of the present study was to investigate the effectiveness of music therapy on behavioral problems of high-functioning children with autism spectrum disorder. The results obtained showed that music therapy is effective in reducing behavioral problems in high-functioning children with autism spectrum disorder. The findings of this research are consistent with the studies of Hamidifard et al. (2023), Arjmandnia et al. (2021), Hoseini (2021), Geiger et al. (2020), Sharma (2018), Ruutel et al. (2014), and Catherine et al. (2010).

In explaining the obtained results, it can be stated that considering that most autistic children have internalizing problems, some researchers have reported that music therapy can regulate the function of the autonomic nervous system (blood pressure, heart rate, and respiration). It seems that better functioning of the autonomic nervous system can reduce an individual's anxiety level and decrease the intensity and frequency of stereotyped behaviors (Lundqvist et al., 2009). This is because researchers have shown that muscle contraction in participants decreases as a result of music therapy. It appears that the reduction in stereotyped behaviors could be due to the decrease in muscle contraction of autistic children during the music therapy process, which through music therapy can be effective in reducing the intensity and frequency of these children's stereotyped behaviors (Aghili et al., 2022). Furthermore, dopamine deficiency in the brain, especially in the striatum, leads to cognitive deficits and psychomotor slowness. Therefore, music therapy by increasing dopamine in the brain leads to an increase in the hormone oxytocin and prevents the occurrence of aggressive behaviors (Hoseini, 2019). Music with a gentle rhythm and calming tempo creates a state of relaxation in these children, leading to a reduction in their physical aggression. Considering the negative effects of chemical drugs used in the treatment of this disorder, music can be used as a therapeutic method to improve the behavioral abnormalities of these children. Mental health is a state of successful performance of mental function, the result of which is productive activities, satisfying

relationships with others, the ability to adapt to changes, and coping with adversities. Therefore, it can be said that engaging in music therapy, and consequently the reduction of behavioral problems in autistic children in various dimensions, can reduce the worry, depression, and pressures experienced by parents, and improve their mental health (Aghili et al., 2022).

In another explanation, it can be said that appropriate music and rhythm control and reduce the excessive activity of the sympathetic nervous system and severe anxiety in these children. By decreasing the activity of the sympathetic nervous system and the level of anxiety, the level of arousal and self-stimulation in these children decreases, and consequently, their behavioral problems are controlled and reduced. Furthermore, the timing structure of music and rhythm in a stable pattern, due to neuromuscular coordination and synchronization of body movements, reduces the intensity and frequency of behavioral problems (Hodgetts et al., 2011). It seems that motor activities create a kind of alternative mechanism for behavioral problems and stereotyped behaviors by providing sensory feedback, and through a type of motor simulation, lead to the control and reduction of these problems in autistic children (Healy et al., 2017). Additionally, musical-motor activities stimulate the limbic system more quickly, and this stimulation leads to the projection of inner states, causing social and communicative interactions to occur. It appears that music makes children with autism spectrum disorder more flexible from their inner world to their surrounding

environment (Mateos-Moreno & Atencia-Doña, 2013).

The study population was limited to children with autism spectrum disorder in Bandar Anzali city. It is suggested that similar research be conducted on affected children in other cities in the future. The lack of a follow-up test was another limitation of the present study; it is recommended that a follow-up test also be conducted in future research.

5. Conclusion

The results of this study showed that music therapy is effective in improving behavioral problems of high-functioning children with autism spectrum disorder and can therefore be useful and used as one of the therapeutic and interventional methods for this disorder by therapists and psychologists in the field of autism spectrum disorders.

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Conflicts of Interest

The Authors declare that there is no conflict of interest with any organization. Also, this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

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