

Research Article

The selected rehabilitation exercise program effect on the emotinal development of autistic children - a single-subject study

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Abstract

Introduction: Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by being one of the most prevalent developmental disorders, marked by difficulties in motor skills, social interactions-emotional, repetitive behaviors, and movements. With the rising prevalence of autism, the challenges and impact of this condition on children, their families, and the broader community underscore the necessity for an extensive rehabilitation training program designed to enhance the emotional development skills of autistic children from early childhood through elementary school years. Hence, the objective of this study is to explore the impact of a targeted rehabilitation training program on the emotional development of autistic children.

Methods: For this research and case study, we chose two autistic children, from a rehabilitation center in Tehran. This selection was made through the A-B-A method, considering their HFA and IQ scores (60-90). The participants were a 12-year-old boy with an IQ score of 67 and an 11-year-old girl with an IQ score of 60. Following their parents' approval, they agreed to take part in the study. Subsequently, they completed a pre-test before beginning the rehabilitation exercises, which were designed to last for 12 weeks, totaling 36 sessions of 60 minutes each. To enhance the precision and success of the targeted exercise program, we employed a single-subject research approach. The assessments were conducted prior to the start of the intervention, followed by the completion of the targeted exercises over 12 weeks (36 sessions) of 60 minutes each, divided into two 30-minute segments with a 10-15 minute break in between. To enhance the precision and efficiency of the targeted training program, a single-subject research approach was employed. Following 18 training sessions and throughout the follow-up period, the participants underwent assessments, and a comprehensive evaluation was conducted at the conclusion and post-training. The (EMS) emotional Development questionnaire were utilized to measure the impact of the targeted training program on the improvement of emosional abilities.

Findings: The research indicated that the targeted rehabilitation activities were successful in enhancing the emotional abilities of children with autism. Initially, the initial data for each participant across the three initial, treatment, and follow-up phases were represented graphically. Subsequently, the consistency and progression sections were graphed against the data from all participants in the initial and treatment phases, and the trend and consistency indices were used to assess the trend's direction and the data's stability. Lastly, the impact of the targeted activities on the improvement of emotional skills was evaluated through both within-situation and between-situation analysis approaches. In male and female subjects, The exercise program had a significant positive effect on improving the girl's emotional questionnaire scores. The scores decreased continuously in both the intervention and post-intervention phases, indicating an improvement in the subject's condition.

Conclusion: The results indicate that a 12-week program of targeted rehabilitation activities, Emotional stability, social maladjustment, personality, and independence in children with autism.

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1. Introduction

Autism spectrum disorder is an intricate disorder of brain development marked by problems in emotional interaction, movement, and repetitive actions (4). It stands as one of the most prevalent pervasive developmental disorders, known for its complexity and the lack of understanding surrounding it (1).

Since 2009, this condition has seen the quickest rise in prevalence, experiencing an average yearly growth of 10.9% (9). A key challenge for a child with autism is a shortfall in social-emotional skills. Learning social-emotional skills helps individuals feel more competent and effective in life challenges and leads to progress in stress management, problem solving, conflict resolution, self-esteem, leadership, and conscientiousness. (Beiranvand et al. 2012). Khosrowash et al. (2019) compared the effectiveness of executive function training and social-emotional training. Social-emotional skills training leads to improved average sustained attention performance in students. (10)

Effective treatments for the core symptoms of autism spectrum disorder have not yet been developed. First-line evidence-based treatments are represented by behavioral therapies (such as the Treatment and Education of Children with Autism and Children with Associated Communication Disorders or Applied Behavior Analysis) (21). The application of drugs (like Risperidone or Aripiprazole) is typically restricted to managing the behavioral aspects of the condition, including irritability or aggression. Regrettably, despite the notable impact on these challenging behaviors, the drug treatment for the fundamental symptoms has often yielded uncertain outcomes and is occasionally hindered by serious adverse side-effects (5).

Families of children with autism are often concerned about potential medication side effects and are constantly seeking more clinical treatments. As a result, in recent years, interest in complementary and alternative medicine has increased, not only in autism spectrum disorder, but also in several pathological conditions (11).

In a study conducted by Sarabi and colleagues (2018), it was demonstrated that engaging in parallel training can enhance social-emotional, communication, and motor abilities, while also diminishing repetitive behaviors among children with autism (15).

Moradi and her team's findings (2021) indicated that children diagnosed with autism and who also have visual impairments tend to struggle with understanding social-emotional cues, empathy, recognizing facial expressions, making decisions, communicating, and engaging in social activities. However, these challenges can be overcome by participating in a consistent training regimen, which leads to improvements in both cognitive and social abilities.

Undoubtedly, selected and targeted programs for children with autism reduce inappropriate behaviors and increase their physical fitness, social and emotional relationships, and the child enjoys these activities (19). Since the teachings and advice through stories, puppet shows (theater), images, videos, etc. become well understood and meaningful for the child, the likelihood of their application and generalization by the child in similar fields increases (20).

Currently, apart from behavioral-based programs, there are few intervention programs to reduce the symptoms of autism that have scientific evidence to support their effectiveness. Conversely, considering the broad effects of developmental issues in individuals with autism, it appears crucial to implement programs designed to address these challenges (2). Given that the diversity of the training program, training methods, and available facilities and spaces for play, school sports spaces, the level of awareness and performance of teachers and physical education instructors, etc. have a facilitating effect on physical and motor development among children. Therefore, an environment filled with sensory, motor, cognitive, and other stimuli can help manage this condition to a certain degree (3). Therefore, conducting this research appears essential for implementing a targeted rehabilitation exercise program aimed at enhancing emotional development disorders in autistic children.

2. Materials and Methods

This study adopted a quantitative, applied research approach, specifically utilizing the case report method. The target population for this investigation consisted of 40 autistic children, aged between 8 and 12 years, engaged in a rehabilitation center located in the northwest Tehran. From this pool, two participants were selected: a girl aged 11, with an IQ of 60, and a boy, aged 12, with an IQ of 67. The selection criteria were based on the Autism Diagnostic Observation Schedule (HFA) and IQ scores, which ranged from 60 to 90. Prior to the study, a specialized consent form for participation in the assessments was completed by the parents, along with a personal characteristics questionnaire.

To enhance the precision and efficacy of the targeted training program, a single-subject methodology was employed, utilizing the A-B-A design. This educational and rehabilitation approach, known as A-B-A, addresses all facets of a child's developmental needs, encompassing sensory-motor, cognitive, social-emotional, self-help, and speech skills. Within this framework, a single subject, such as an individual or a group, is the focus of study at any given time. The outcomes of the therapeutic or educational interventions are then assessed in relation to these specific subjects (13).

The inclusion criteria for participation in the study and the selection of subjects were established on the basis of several criteria. These criteria included being between the ages of 8 and 12, having a diagnosis of Autism Spectrum Disorder (ASD) according to the DSM-IV-TR criteria and validated through ADI-R diagnostic assessments, and obtaining a confirmation from a psychiatrist. Additionally, participants were required to demonstrate verbal comprehension to the level of recognizing imperative verbs and significant body parts. Furthermore, the absence of motor disabilities was a prerequisite for eligibility.

Initially, a pre-test was administered to assess the variables related to the targeted rehabilitation training program-i-e- social skills- over twelve weeks, encompassing a total of 36 sessions, with three sessions held per week, each lasting 60 minutes. The first segment of these sessions was allocated to type 1 activities, which included warm-up exercises, gross motor skills, and perceptual-motor-heading tasks, each allocated 10 minutes for rest. Subsequently, type 2 activities were introduced, which encompassed fine motor skills, social-emotional skills, and cognitive abilities, each session allocated 30 minutes.

Following a period of 18 weeks, the test was repeated, and finally, a post-test was conducted to evaluate the outcomes of the rehabilitation training program. And the direction and outcome of the selected training program on development Emotional development is a complex task that begins in infancy and continues into adulthood.

Table 1 - Warm-up + Type 1 activities (30 minutes) + Cool-down // Gross motor skills

Perceptual-motor exercises

Sessions	Static and dynamic balance	Movement and manipulation Lateral superiority and body recognition	Spatial and temporal perception, hearing, shape perception, and orientation	Perceptual-motor skills Coordination and stereotyped behaviors	Strength, power, agility, flexibility
1	Walking in the Footsteps of the Alphabet (Ahmadi, Be Pajouh 2016)	Rolling a ball on the ground (Galaho, Test 2011)	Passing over and under obstacles (Galaho, Ozmon 2011)	All-hand walking (knees not on the ground) (Abbasi et al. 2018)	Vertical jump and hitting the ball (Sheikh et al., 2019)
2	Jumping pairs within a square (Kashi et al. 2018)	Running through circles (Emami et al. 2018)	Stepping inside the ladder (Werner-Reini, translators, Sazmand, Tabatabaeinia 2014)	Winding a thread around a spool while walking (Abbasi, Ebrahimpour 2017)	Sun Salutation Yoga Poses (Beck 2015)
3	Hopping around obstacles (Galaho, Ezmon 2011)	Catching the ball and moving the ball with the other hand (Kayhani, Kowsari 2013)	Drawing shapes on the board by indicating their direction (Sheikh et al., 2019)	Making Bubbles and Chasing Them (Baghandeh et al. 2015)	Running through obstacles and moving sandbags (Sheikh et al., 2019)
4	Stork Movement (with eyes open and closed) (Matrin, Dirjitkar 2018)	Dribbling the ball through the cones and shooting (dominant foot) (Moradi et al. 2017)	Running and kicking, to a ball thrown by the tester (Galahou, Azmoon 2011)	Plastic Ring Game (Werner-Reni, Translators, Sazmand, Tabatabaeinia 2014)	Hitting a Medicine Ball (Kashi et al. 2018)
5	Moving in a straight line backwards and sideways (Najafabadi et al., 2018)	-Opening and closing the lock -Passing a hat (Pir Ali et al. 2020)	Running and standing with whistle signal (Kashi et al. 2018)	Jumping and Clapping (Abbasi, Ebrahimpour 2017)	Sun Salutation Yoga Exercises (Beck 2015)
6	Jump with rotation (Abbasi et al. 2018)	Throwing the ball towards the basketball hoop (with eyes open and closed) (Kashi et al. 2013)	Chasing a Pendulum Ball with the Eye (Werner-Reini, Translators, Sazmand, Tabatabai Nia 2014)	Badminton service (Isaac 2005)	Tug of war (Moradi et al. 2015)
7	Yoga movement (tree) (Beck et al. 2015)	Hitting the ball with a golf club (dominant hand) (Galaho, Azmoon 2011)	The subject and the tester strike each other with two sticks (Sheikh et al. 2019)	Catching the ball between the legs and jumping with the feet closed	Passing the ball, dribbling and passing the ball (Payne & Isaacs 2002, translated by

				Abbasi et al. 2018(	Khalaji and Khajou 1382)
8	Jumping over the line (paired and single leg) (Moradi et al. 2015)	Passing the ball (ground and air) (Kathleen M. Haywood 2009)	Drawing and making shapes on paper and Play-Doh, respectively (Sheikh et al. 2019)	Crossing an obstacle and simultaneously catching a thrown ball (Abbasi et al. 2018)	Sun Salutation Yoga Poses (Beck 2015)
9	Hopping in plastic rings (Payne and Isaacs 2002, translated by Khalaji and Khajou 1382)	Naming of body parts by the tester, touching and moving by the subject (Kashi et al. 2018)	Pointing in different directions by the tester and the subject moving in the same direction (Kashi et al. 2018)	Hand rings (Nikbakht2020)	Multi-circuit movements (Hashemi, Hamayat Talab 2015)
10	Yoga pose(Angel pose) (Hadavi et al. 2017)	Zigzag running through obstacles (Kashi et al. 2018)	Playing with geometric shapes (Sif 2014)	Jumping to both sides of the rope and clapping at the same time (Beigi and Pirzadi 2017)	Sun Salutation Yoga Poses (Beck 2015)
11	Walking on toes-heels (Kathleen M. Translators, Namazizadeh, Aslankhani 2009)	Mini-basketball dribbling and obstacle crossing (Baghandeh et al. 2015)	Throwing balls of different sizes in different directions (Valinia et al. 2016)	Gym Ball Exercises (Babadi et al. 2016)	-Dumbbell shoulder press -Dumbbell leg squat -Lunges (Qasemi et al. 2012)
12	Standing on floated Car tire (Galaho & Ozmoon 2011(	Animal Movement Imitation Game (Alisi et al., translated by Siavoshi 2015)	-Starting and stopping the tire with whistle signal -Climbing inside the tire (Werner-Reini, translators, Sazmand, Tabatabaei Nia 2014)	Drawing a circle simultaneously with both hands (Arabi et al. 2019)	Yoga poses(tree, butterfly, cat) (Beck et al. 2015)

Table 2- Type 2 Activities (30 minutes)

Fine motor skills Social-emotional skills Cognitive skills

Sessions	Movement and manipulation	Lateral dominance and body recognition Static and dynamic balance	Spatial and temporal perception, hearing, shape perception, and orientation	Perceptual-motor skills Coordination and stereotyped behaviors	Strength, power, agility, flexibility
1	Walking in the Footsteps of the Alphabet (Ahmadi, Be Pajouh 2016)	Rolling a ball on the ground (Galaho, Azmoon 2011)	Passing over and under obstacles (Galaho, Azmoon 2011)	All-hand walking (knees not on the ground) (Abbasi et al. 2018)	Vertical jump and hitting the ball (Sheikh et al., 2019)
2	Jumping pairs within a square (Kashi et al. 2018)	Running through circles (Emami et al. 2018)	Stepping inside the ladder (Werner-Reini, translators, Sazmand, Tabatabaeinia 2014)	Winding a thread around a spool while walking (Abbasi, Ebrahimpour 2017)	Sun Salutation Yoga Poses (Beck 2015)
3	Hopping through the obstacles (Galaho, Azmoon 2011)	Catching the ball and moving the ball with the other hand (Kayhani, Kaushari 2013)	Drawing shapes on the board by indicating their direction (Sheikh et al., 2019)	Making Bubbles and Chasing Them (Baghandeh et al. 2015)	Running through obstacles and moving sandbags (Sheikh et al., 2019)
4	Stork Movement (with eyes open and closed) (Matrin, Dirjitkar 2018)	Dribbling the ball through the cones and shooting (dominant foot) (Moradi et al. 2017)	Running and kicking, to a ball thrown by the tester (Galahou, Test 2011)	Plastic Ring Game (Werner-Reni, Translators, Sazmand, Tabatabaeinia 2014)	Hitting a Medicine Ball (Kashi et al. 2018)
5	Moving in a straight line backwards and sideways (Najafabadi et al., 2018)	-Opening and closing the lock -Passing a hat (Pir Ali et al. 2020)	Running and standing with whistle signal (Kashi et al. 2018)	Jumping and Clapping (Abbasi, Ebrahimpour 2017)	Sun Salutation Yoga poses (Beck 2015)
6	Jump with rotation (Abbasi et al. 2018)	Throwing a ball towards a basketball hoop (with eyes open and closed) (Kashi et al. 2013)	Chasing a Pendulum Ball with the Eye (Werner-Reini, Translators, Sazmand, Tabatabai Nia 2014)	Badminton service (Isaac 2005)	Tug of war (Moradi et al. 2015)
7	Yoga Movement (Tree) (Beck et al. 2015)	Hitting the ball with a golf club (dominant hand)	The subject and the tester strike each other with two sticks (Sheikh et al. 2019)	Catching the ball between the legs and jumping with the feet closed	Passing the ball, dribbling and passing the ball (Payne and Isaacs 2002, translated by

		(Galaho, Azmoon 2011)		Abbasi et al. 2018)	Khalaji and Khajou 1382)
8	Jumping over the line (paired and single leg) (Moradi et al. 2015)	Passing the Ball (Ground and Air) (Kathleen M. Haywood (2009)	Drawing and making shapes on paper and Play-Doh, respectively (Sheikh et al. (2019)	Crossing an obstacle and simultaneously catching a thrown ball (Abbasi et al. (2018)	Yoga pose (Tree) (Beck et al. 2015)
9	Lying in plastic rings (Payne and Isaacs 2002, translated by Khalaji and Khajou (1382)	Naming of body parts by the tester, touching and moving by the subject (Kashi et al. 2018)	Pointing in different directions by the tester and the subject moving in the same direction (Kashi et al. 2018)	Hand rings (Nikbakht1399)	Multi-circuit movements (Hashemi, Hamayat Talab (2015)
10	Yoga pose(Angel) (Hadavi et al. 2017)(	Zigzag running through obstacles (Kashi et al. 2018)	Playing with geometric shapes (Sif 2014)(	Jumping to both sides of the rope and clapping at the same time (Beigi and Pirzadi 2017)(	Sun Salutation Yoga Poses (Beck 2015)(
11	Walking on toes-heels (Kathleen M. Translators, Namazizadeh, Aslankhani 2009)(	Mini-basketball dribbling and obstacle crossing (Baghandeh et al. 2015)	Throwing balls of different sizes in different directions (Valinia et al. 2016)	Gym Ball Exercises (Babadi et al. 2016)(	-Dumbbell shoulder press -Dumbbell leg squat -Lunges (Qasemi et al. 2012)
12	Standing on a floated car tube (Galaho & Azmoon 2011)	Animal Movement Imitation Game (Alisi et al., translated by Siavoshi 2015)	-Starting and stopping the tire with whistle signal -Climbing inside the car tire (Werner-Reini, translators, publisher, Tabatabaei Nia 2014)	Drawing a circle simultaneously with both hands (Arabi et al. 2019)	Yoga poses (tree, butterfly, cat) (Beck et al. 2015)

3. Results

The present study is a single-subject study using an A-B-A design. In this design, the target behavior is measured repeatedly under the condition and intervention, and after recording data in the intervention condition, the second baseline condition begins. Adding a second baseline condition increases the control for confounding variables and increases the internal validity of the design. Researchers working in the field of single-case designs pay as much attention to issues of internal and external validity as researchers working in group experiments. (23) Table 3 shows the descriptive statistics related to the research subjects. 1 girl and 1 boy participated in this study.

Table 3- Descriptive statistics related to age, height, and weight

	Age	Height (m)	(kg) weight	Intelligence
Boy	12	152	55	67
Girl	11	150	48	60

Implementing the targeted exercise program had a significant effect on improving the emotional development of autistic children.

Boy's emotional Test

Table 4-The boy`s Mean emotional Test scores

Boy's emotional questionnaire	Pre intervention			intervention			Post intervention		
	1	2	3	4	5	6	7	8	9
Quantitative score	107	106	105	98	95	95	86	87	88
Quality score	Very unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Relatively stable	Relatively stable	Relatively stable

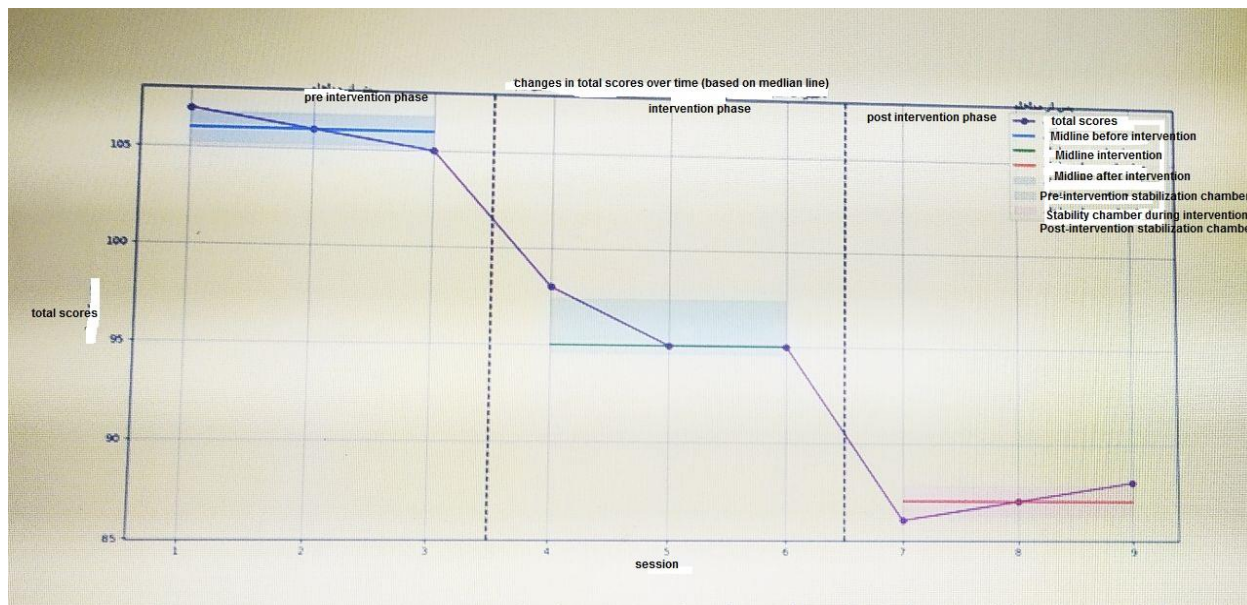
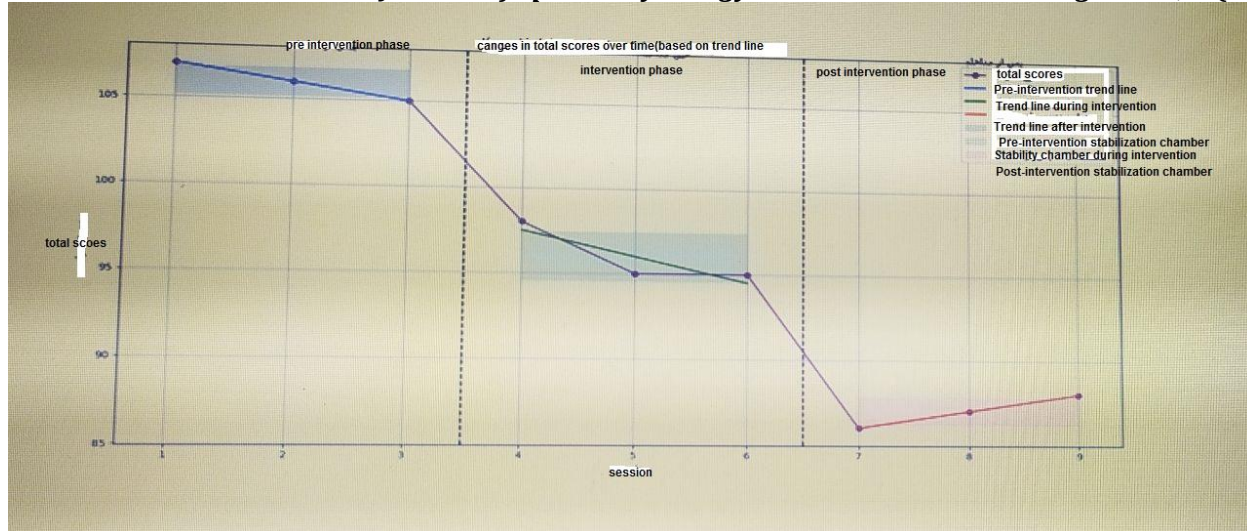


Figure 1 - Average scores on the boy's emotional test based on the trend line (top) and the median line (bottom) for the boy subject

The exercise program had a significant positive effect on improving the boy's emotional questionnaire scores. The scores decreased continuously in both the intervention and post-intervention phases, indicating an improvement in the subject's condition.

Girl's emotional test

Table 5-The Girl`s mean emotional Test Scores

girl's emotional questionnaire	Pre intervention			intervention			Post intervention		
	1	2	3	4	5	6	7	8	9
Quantitative score	124	120	118	100	98	98	92	91	91
Quality score	Very unstable	Very unstable	Very unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable

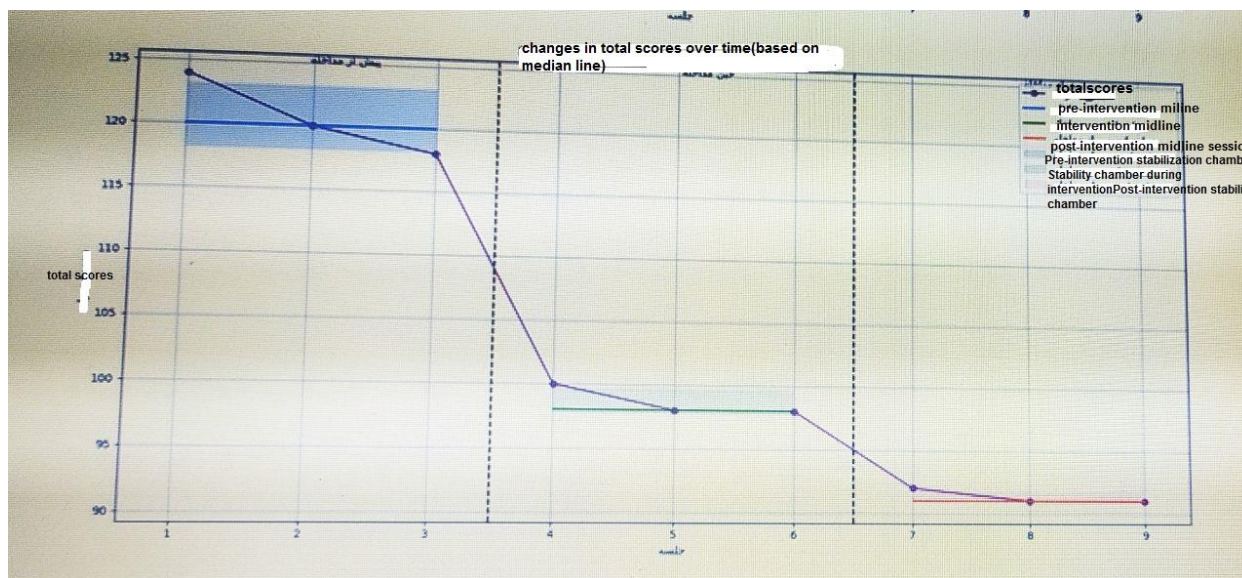
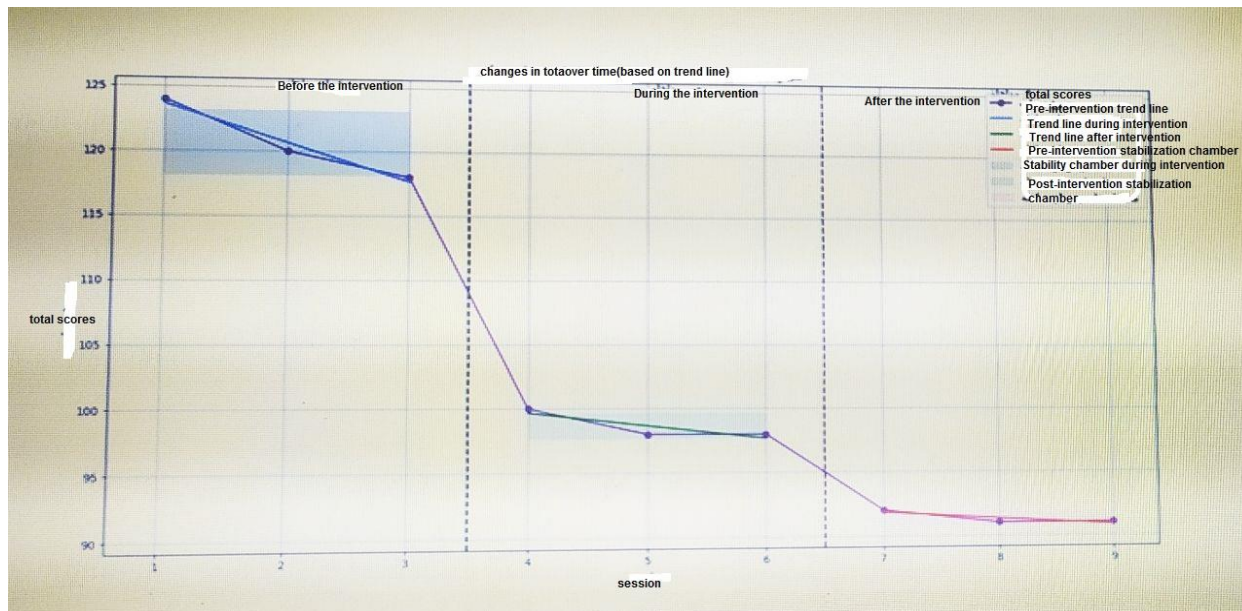


Figure 2 - Average scores on the girl's emotional test based on the trend line (top) and the median line (bottom) for the boy subject

The exercise program had a significant positive effect on improving the girl's emotional questionnaire scores. The scores decreased continuously in both the intervention and post-intervention phases, indicating an improvement in the subject's condition.

Darvishi et al. (1402) in a study examined the effectiveness of social-emotional skills training on theory of mind in children with autism. The results showed that social-emotional skills training can affect theory of mind in children with autism.(6)

3. Discussion

The findings of the study indicate that the targeted rehabilitation exercise program significantly influenced the enhancement of emotional skills among participants, encompassing both male and female subjects. Individuals with autism spectrum disorder (ASD) present considerable challenges to social- emotional development. Consequently, they may struggle with communication and exhibit difficulties in engaging in social behaviors, including friendship and recognizing others' emotions through facial expressions or body language. Such individuals often face challenges in forming interpersonal relationships and may find it challenging to communicate effectively with others (22).

The findings of the present study align closely with those observed in previous studies, including those conducted by Uness et al. (2020), Hire and Sava et al. (2020), Namedet and Kobenn (2020), Baharani et al. (2019), and Moradi et al. (2013). The results of the study by Roohpaver (2015) showed that the application provided by the researcher had a positive effect on the social-emotional development of preschool children and improved the emotional skills of these children. Another characteristic of people with autism is inappropriate emotional reactions in certain social situations. They may show almost constant emotional behaviors in different emotional situations. Some of them may show shifted emotional behaviors from giggling and hysterical laughter to sobbing and crying loudly, which is independent of environmental events. These people can quickly go from one pole to another, without having a reason. (16)

4. Conclusion

In his study, Hambick (2017) elucidated the influence of training programs and participation in games on social development. Phenille and Burger (2018), along with Herbart et al. (2017), posited in their research that practical behavior analysis techniques are deemed the most effective approach for children with autism. Consequently, the application of Applied Behavior Analysis (ABA) methodologies has been shown to reduce inappropriate behaviors while enhancing performance and social interactions (12).

Rhythmic games and exercises serve as the foundation for facilitating interactions among children with their peers, promoting coordination and participation within group settings, and enhancing social-emotional skills in young individuals. Subjects, perceiving themselves as being evaluated, are less likely to fear making mistakes, as they believe these errors will not result in the loss of opportunities such as education and learning. Consequently, this mindset encourages more thoughtful responses, leading to greater success. This, in turn, boosts their confidence levels. Moreover, these activities contribute to the improvement of social skills in autistic children (16).

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Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: S.M.B , K.M , E .A , A. K ;
Methodology: S.M.B , K.M , E .A , A. K.; Software: S.M.B , K.M , E .A , A. K ;
Validation: S.M.B , K.M , E .A , A. K.;
Formal analysis: S.M.B , K.M , E .A , A. K ; Investigation:
S.M.B , K.M , E .A , A. K ; Resources: S.M.B , K.M , E .A , A. K
; Data curation: S.M.B , K.M , E .A , A. K ; Writing -
original draft S.M.B , K.M , E .A , A. K ; Writing - review
& editing S.M.B , K.M , E .A , A. K .; Visualization: S.M.B , K.M , E .A , A. K ;
Supervision: S.M.B , K.M , E .A , A. K ;
Project administration: S.M.B , K.M , E .A , A. K . ;
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