

Research Article

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

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Abstract

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Background: 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, 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 social 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 social development of autistic children.

Materials and 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.

Results: The results of the T-test showed the significant effect of eight weeks of functional and Extra functional exercises on dorsi Flexion, Plantar Flexion and ground reaction force. ($P \leq 0/001$).

Result: The research indicated that the targeted rehabilitation activities were successful in enhancing the social abilities of children with autism. In male and female subjects, the mean scores of the Vineland test increased in the post-intervention phase. They demonstrated improvement across all subtests related to general self-help, self-help in eating, self-help in dressing, self-leadership or self-direction, movement and mobility, as well as communication and sociability.

Conclusion: The results indicate that a 12-week program of targeted rehabilitation activities, incorporating play and rhythmic exercises, enhances a child's ability to engage with peers, improve coordination, increase involvement, and boost self-assurance and social abilities in children with autism.


Keywords:

autism, targeted exercise program, social growth.

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1. Introduction

Autism spectrum disorder is an intricate disorder of brain development marked by problems in social 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 skills. Issues include a reduced ability to maintain eye to eye contact, minimal interest or attraction to human faces, difficulties in initiating physical touch, and challenges in engaging in cooperative play, among others (19).

Developing the ability to interact socially enhances an individual's social maturity and skill level. In children with autism spectrum disorder, inadequate social skills lead to difficulties in forming friendships and often result in neglecting others (8). Such inappropriate social conduct can lead to challenges in social integration. Hence, it's crucial to explore methods for intervention and support. Engaging in organized movement activities and exercise programs will be instrumental in this process. Isaacs (2002) states that physical activity and social acceptance are considered the most important elements at every phase from early years to old age (6). 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, 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 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).

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, self-help, and speech skills. Within this

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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, 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-IR 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. This post-test was complemented with the Vineland test and the Social Interaction and Communication Questionnaire (GARS), which were employed to measure the impact of the targeted training program on the enhancement of social skills.

The Vineland Test represents a developmental assessment tool designed to evaluate an individual's capacity to fulfill their practical requirements and assume responsibility. This comprehensive scale encompasses a wide age range, extending from birth to over 25 years, with its efficacy demonstrating a peak at younger ages, particularly within populations with intellectual disabilities. The scale comprises a total of 17 items. It is structured into eight distinct categories: general self-help, self-help in eating, self-help in dressing, self-control, employment, language communication, mobility, and socialization.

The Vineland Scale underwent standardization procedures involving 620 participants, encompassing both genders. The resulting coefficient, with a reproducibility rate of 0.92, was subsequently reported.

The Gars-2 Test (GARS), a diagnostic tool for individuals with autism, was conceptualized by Gilliam in 1994. This assessment was subsequently validated and underwent evaluation in 2011 at the Isfahan Autism Center by Ahmadi and associates. The assessment was calibrated against norms specific to the Iranian community, and its psychometric characteristics were scrutinized through the analysis of 100 participants,

comprising 81 boys and 19 girls, spanning the ages of 3 to 18 years (2).

The Gars-2 assessment tool is composed of three distinct subscales, each comprising a total of 14 items. In the context of this study, the second subscale, which pertains to communication (characterized by the description of both verbal and nonverbal behaviors), was selected for analysis. Specifically, this subscale included questions 15 to 28. Concurrently, the third subscale, focusing on social interaction, was chosen, encompassing questions 29 to 42. To ascertain the internal consistency and reliability of the Gars-2 scales, the Cronbach's alpha coefficient was employed. The results indicate that the alpha coefficient for the communication subscale is 0.86, while for the social interaction subscale, it stands at 0.94 (2).

Considering the distinct physical and mental conditions of the participants, they are permitted to take rest periods during the various stages of the test instructions so as to mitigate the additional pressure that might otherwise be exerted on them to complete the test. Furthermore, verbal encouragement and gifts are employed to enhance motivation throughout the duration of the test. The training program is structured as follows: (Warm-up activities of the first category, encompassing cognitive-motor exercises, static and dynamic balance, movement skills, manipulation, lateral superiority, body recognition, spatial and temporal perception, hearing, shape and orientation perception, strength, power, agility, flexibility, coordination, and stereotyped behaviors, concluding with a 30-minute cool-down period). The second type of activities include: fine motor skills and tactile development, social-emotional skills, problem-solving and cognitive skills, reasoning, creativity, attention, and spatial visualization (30 minutes).

Towards the conclusion of the session, Jacobs' Breathing Exercises were executed with the aim of facilitating both mental and muscular relaxation, as well as the reduction of stress and anxiety. This exercise program was designed with the objective of comprehensively identifying the various weaknesses and disorders prevalent among autistic children. For each identified disorder, specific exercises were formulated, accompanied by detailed instructions on the execution of each movement. These instructions, along with relevant images, are included in the 60-page research paper. However, due to space constraints, only a selection of the exercise program has been outlined in this document.

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
۱	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)
۲	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)

۳	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)
۴	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)
۵	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)
۶	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)
۷	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 Abbasi et al. 2018(	Passing the ball, dribbling and passing the ball (Payne & Isaacs 2002, translated by Khalaji and Khajou 1382)

۸	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)
۹	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)
۱۰	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)
۱۱	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)
۱۲	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)	Dribbling the ball through the cones and shooting	Running and kicking, to a ball thrown by the tester (Galahoo, Test 2011)	Plastic Ring Game (Werner-Reini, Translators, Sazmand,	Hitting a Medicine Ball (Kashi et al. 2018)

	(Matrin, Dirjitkar 2018)	(dominant foot) (Moradi et al. 2017)		Tabatabaeinia 2014)	
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) (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 Abbasi et al. 2018(	Passing the ball, dribbling and passing the ball (Payne and Isaacs 2002, translated by 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	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)

		(Kashi et al. 2018)			
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

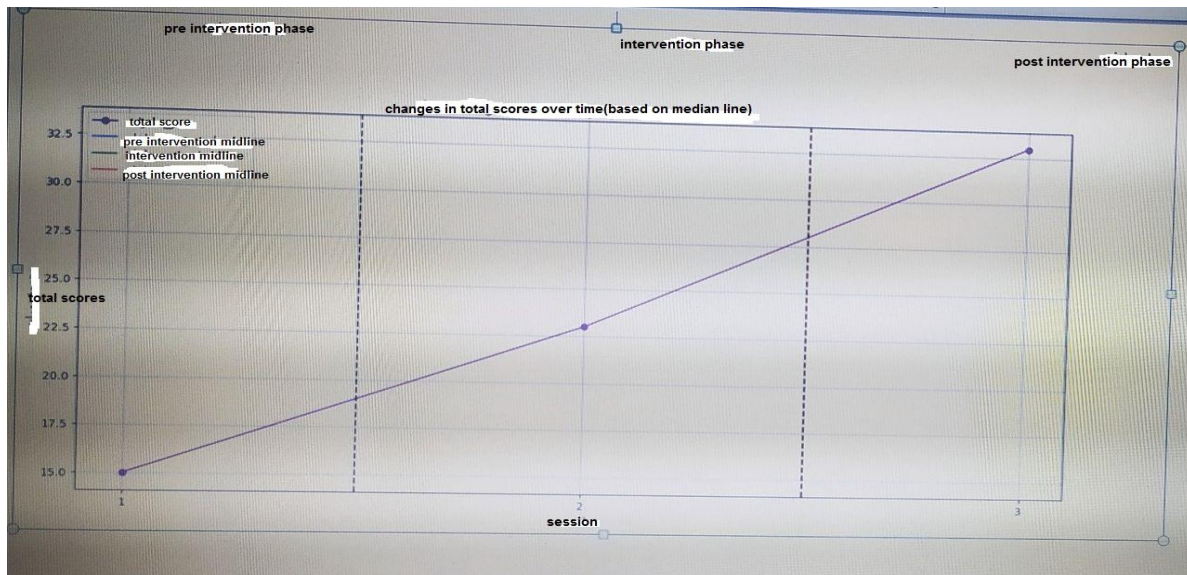
Implementing the targeted exercise program had a significant effect on improving the social development of autistic children.

Boy's Vineland Test

Table 4-The boy's Mean Vineland Test scores

Questionnaire Question	Pre intervention	intervention	Post intervention
General Self-Help	2	3	4
Self-Help in Eating	2	3	4
Self-Help in Dressing	6	7	9
Self-leadership	.	1	2
Career issues	2	3	5
Movement and movement	1	2	3
Communication (voice imitation, noise, laughter)	1	2	3
Social	1	2	3
Total	15	23	33

- **Figure 1** - Mean Wayland Test scores for boys



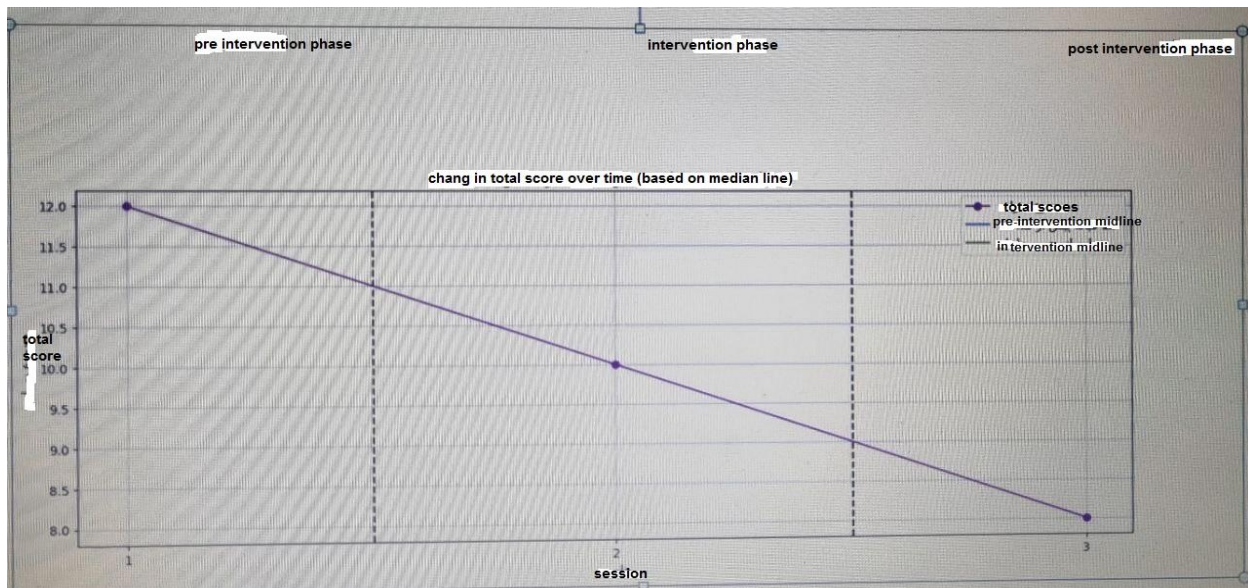
- Pre-intervention phase: The lower numerical values represent the baseline condition of the subject prior to any intervention.
- Intervention phase: There was a notable increase in grades across most variables, suggesting a positive impact of the interventions.
- Post- intervention phase: Grades in all variables have shown a consistent upward trend, indicating the enduring stability of the positive outcomes associated with the exercise program.

Boy's Vineland Test

Table 5-The Girl`s mean Test Scores

Questionnaire Question	Pre-invention	Intervention	Post-intervention
General self -help	1	2	3
Self -help in eating	1	2	3
Self -help in wearing	2	3	5
Self -guidance	0	1	2
Job issues and businesses	1	1	2
Moving and moving movement, commuting	1	1	2
Communication (voice imitation, noise, laughter)	0	1	2
Sociability	0	1	1
Total	5	12	20

Figure 2-Mean Girl Test Scores



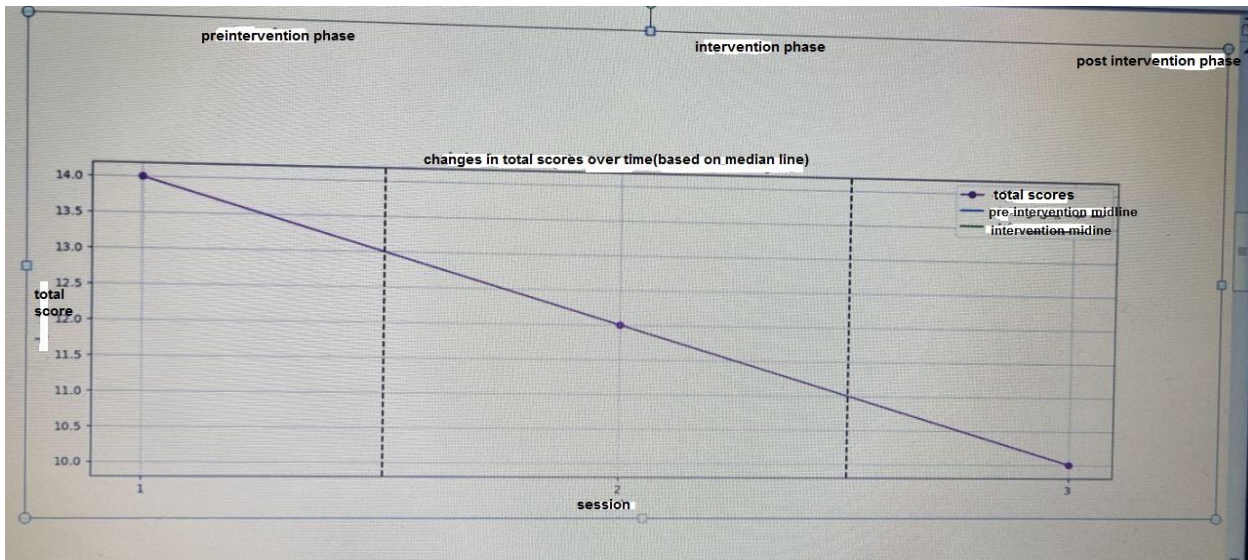
These results show that the impact of the intervention has been very positive and significant.

The boy's social interaction test

Table 6-Mean Social Interaction Test Scores

Questionnaire	Pre0intervention	Intervention	Post-intervention
Boy's Social Interaction Questionnaire	12	10	8

Figure 3-Average Social Interaction Test Scores



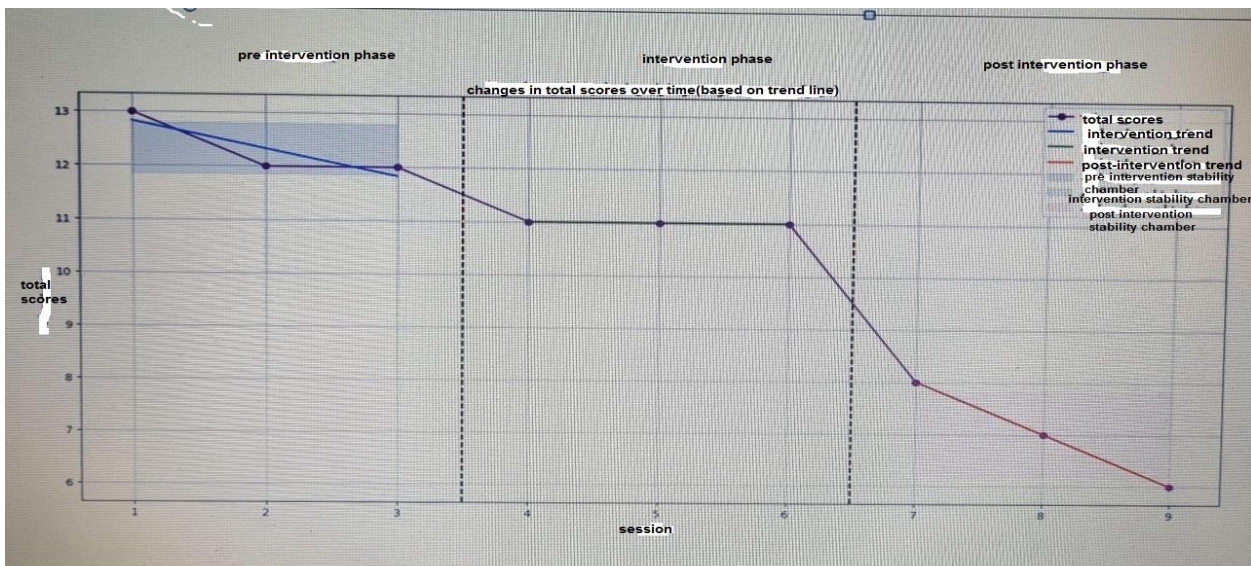
- Pre- intervention phase: The initial scores at this stage have the highest value.
- Intervention phase: It is observed that during this stage, there is a noticeable decline in scores, which suggests a positive impact of the implemented interventions.
- Post- intervention phase: Subsequent to the intervention phase, there is a sustained decline in grades, further substantiating the efficacy of the training program.

The girl's social interaction test

Tables 6-The Girl's mean Social Interaction Test Scores

Questionnaire	Pre-intervention	Intervention	Post-intervention
The Girl's Social Interaction Questionnaire	14	12	10

Figure 4-Average Girl's Social Interaction Test Scores



The findings indicated that the targeted rehabilitation training program exerted a positive influence on the social interaction of the girl.

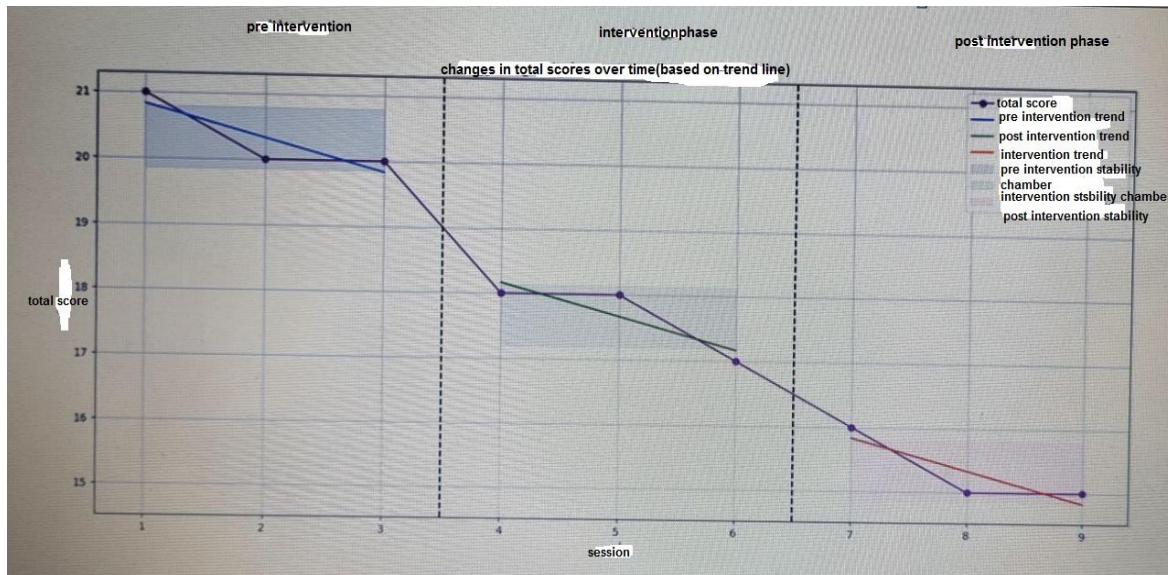
The girl's communication test

Table 8- The Girl's Communication Test Scores

1.

The girl's communication questionnaire	Pre-intervention			Intervention			Post-intervention		
	1	2	3	4	5	6	7	8	9
Score	21	20	20	18	18	17	16	15	15

Figure 6- The Girl communication test scores based on the trend line (top) and the mid line (bottom)



The training program has demonstrated a significant positive influence on enhancing the girl's performance in the communication questionnaire. Scores have consistently decreased throughout both intervention phases and post-intervention, reflecting an improvement in the subject's status.

4. Discussion

The findings of the study indicate that the targeted rehabilitation exercise program significantly influenced the enhancement of social skills among participants, encompassing both male and female subjects. Individuals with autism spectrum disorder (ASD) present considerable challenges to social 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).

Conclusion

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 Baharani et al. research results (2019) further corroborate the notion that interventions involving game therapy and rhythmic movements significantly enhance social interactions among children capable of engaging in autistic play and rhythmic exercises. These activities serve as a foundation for facilitating interactions between children and group members, thereby improving social participation and the development of social skills in children. Given that the participants are assessed and perceive that errors in the game could result in missed opportunities, such as educational and academic pursuits, it is advisable to adopt a more reflective approach in response. This strategy is likely to enhance their success rates. Consequently, it elevates their self-esteem and, in the long run, fortifies their social competencies (16).

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).

Treatment of Autism that ABA is the Sole Intervention for Comprehensive and Sustainable Social and Communication Skill Enhancement in Children with Autism" (12). This study's findings indicate that Applied Behavior Analysis (ABA) stands as the sole intervention that yields comprehensive and sustainable improvements in the social and communication skills of children with autism. The research revealed that the targeted exercise program significantly enhanced the social development of the participating children. To elucidate the impact of a rehabilitation exercise program on the social development of the children, the following explanation can be provided. Children with high-functioning autism often experience feelings of inferiority, accompanied by social fear and anxiety, primarily due to challenges in social interactions and deficiencies in social skills. This can lead to a sense of worthlessness, defeat, and failure, as well as difficulties in adapting to various environments. Typically, these challenges manifest in a range of forms, such as isolation, heightened sensitivity, aggression, depression, and anxiety (14).

One of the elements that fortifies social bonds among children is the physical and physiological transformations they undergo. These changes enable children to showcase their capabilities to the perspectives of various groups, coaches, and even spectators, thereby fostering communication within society.

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 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 study was approved by the ethics committee of Kermanshah University of medical sciences. (IR.KUMS.REC.1403.509). written informed consent has been obtained from the patients to participate in the study and paper.

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: A.D., S.M.; 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: A.D., S.M.; S.M.B, K.M, E.A, A.K; Writing - original draft: A.D., S.M.; 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: A.D., S.M.; S.M.B, K.M, E.A, A.K; S.M.B, K.M, E.A, A.K; Project administration: S.M.B, K.M, E.A, A.K; Funding acquisition: S.M.B, K.M, E.A, A.K;

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