Original Article

Hippotherapy and its effect on behavioral and executive disorders in children with autism spectrum disorder

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ABSTRACT

Children with Autism have social, cognitive, and behavioral problems. Hippotherapy can play an effective role in the communication and educability of this group of children. Therefore, this study is about investigating the effect of Hippotherapy on behavioral disorders and executive function in children with an autism spectrum disorder. The present study was designed as a pre-test-post-test as a one-group intervention method. The treatment team performed this method on eight children aged 9-12 years with autism. A questionnaire of behavioral disorders in children with an autism spectrum (parent form) and a behavioral rating questionnaire of executive function was used as instrument in this study. Data analysis has been performed using SPSS statistical software version 20.

After the intervention, the mean score of executive function and its dimensions were significantly lower than before the intervention which shows better executive function after the intervention ($P = 0.012$). The results also showed that after the intervention, behavioral problems are significantly less than before the intervention, which shows fewer behavioral problems after the intervention ($P = 0.012$). The results show that hippotherapy decreases behavioral problems in children with an autism spectrum disorderTherefore, hippotherapy can be performed as an effective treatment along with conventional clinical treatments for children with an autism spectrum disorder.

Keywords: Autism disorder, Behavioral disorders, Children, Hippotherapy

Introduction

Living in one's world or being self-centered is the real sense of autism and a child with autism seems self-centered to others [1]. Autism spectrum disorder is a developmental disability defined by diagnostic criteria. It includes defects in social communication and interaction, a pattern of repetitive (stereotyped) behaviors and interests, and the existence of limiting patterns that may persist throughout life [2]. Early intervention in childhood can be effective in reducing the symptoms of autism [3]. Epidemiological studies report that the prevalence of autism in Iranian children is 95.2 per 10,000 children in Iran, which indicates increasing statistics of autism in children [4].

Music therapy [3], cognitive-behavioral therapy [5], parent's education about sleep problems in children with autism [6], aerobic exercise training and motor skills training [7], and hippotherapy [5] are effective non-pharmacological treatments for children with autism spectrum disorder based on cognitive, developmental, and behavioral approaches. In recent years, relations between humans and animals have become an important topic in social research. The therapeutic efficacy of horses is amazing in animal therapy [8, 9]. Many countries around the world widely use horse therapy. Hippotherapy is a type of physical, occupational, and speech therapy in which a therapist provides sensory and motor inputs uses the motor features of a horse [10]. Parents are generally satisfied with horse-based programs and their children's development as studies show [11]. The improvement of the child's ability to move is one of the benefits of hippotherapy reported by parents [12]. Not only hippotherapy is used for children and adolescents with autism but also it is used for adolescents with emotional and behavioral

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disorders [13]. According to researches, this treatment is effective especially for those who do not respond to traditional therapies [14]. However, hippotherapy does not change all of a child's behaviors; it can improve certain aspects of his or her social functioning [15].

Hippotherapy is effective on the psychological, cognitive, behavioral, and communication functions of children. Occupational therapists, speech therapists, and physiotherapists for people with autism [16] can use this treatment. Last studies show that hippotherapy has been used in various fields such as children with cerebral palsy, MS patients [17], Parkinson's [18], chronic low back pain [19], but few studies have been performed on people with autism spectrum disorder regarding the use of hippotherapy in patients. As the results of studies, hippotherapy for children with autism spectrum disorder and interaction with animals can facilitate communication between autistic children and others and improve the physical condition of this group of children [18]. Changes are made such as the increase in muscle tone, strength, posture, musculoskeletal flexibility, balance/coordination, and improvement in motor function. So far, most of the studies about this subject have been done outside Iran, and most have been about the physical activities and sometimes the psychological aspects of children with autism. Therefore, the present study is designed and performed to investigate the effect of hippotherapy on behavioral disorders and executive function in children with an autism spectrum disorder.

Materials and Methods

The type of this research is a single-group clinical trial (pre-test-post-test). 9-12 years old children are the research community who are members of the Autism Association of Urmia in 2019 and met the inclusion criteria. There were some entry criteria in this study such as children diagnosed with an autism spectrum disorder in the medical record, membership of children in the Urmia Autism Association, which was used with the permission of the association and the consent of parents in the study, and age range of 9-12 years. No medical prohibition has been for children to attend educational sessions. There were also some exclusion criteria such as children with a history of self-harm or altercation or suicide, children with a history of animal violence or fear of animals, children with underlying diseases in addition to autism (such as epilepsy, hypertension, diseases Psychiatry, asthma, and other illnesses) and children with a history of hippotherapy.

Data collection method

In this study, the questionnaire "Behavioral disorders of children with autism spectrum (parent form)" and the behavioral grading of the executive function questionnaire were used, in addition to the questionnaire related to demographic information of children with autism. The behavioral disorders questionnaire has 40 questions and tests the behavioral disorders of children with autism spectrum based on Likert's five-choice scale (from strongly agree to strongly disagree). This questionnaire has been validated in the country. Cronbach's alpha coefficient was estimated more than 0.941 in determining the reliability of the questionnaire.

The questionnaire "Behavioral Grading of Executive Function" has also 86 items and Guinea *et al.* have developed and validated it in 2000. It evaluates behaviors related to children's executive functions for teachers and parents in separate forms. This questionnaire has two indicators of behavior regulation and metacognition. In the calculation, the validity of the questionnaire was ranged from 0.80 to 0.98, and the reliability of this questionnaire for the behavior regulation index, metacognition index, and the whole questionnaire was respectively estimated at 0.84, 0.88, and 0.86, by the researcher.

Hippotherapy sessions were performed to collect data with the treatment team (including handler, companion, and therapist or equestrian instructor) after giving the necessary preparations to the children and obtaining the consent of the parents. The handler is the person who controls and guides the horse. A companion is someone who takes care of the child and helps him perform the exercises correctly. The therapist is also the person who is responsible for holding meetings and performing programs regularly. A briefing and training session was held for people who wanted to play the role of handlers and companions before the Hippotherapy sessions start. In this study, a psychiatrist and an equestrian instructor conducted treatment sessions. All children in this study were insured before the treatment sessions start. Informed written consent was obtained from children, adolescents, and parents. The equestrian instructor has an official degree in this field. The therapist is a psychiatrist who has passed the necessary training courses including hippotherapy rules, horse movements, horse psychology, and specialized information about autism. He is also familiar with health care and has a degree in cardiopulmonary resuscitation. In addition, an agreement was written between the therapist, the Urmia Autism Association, and the Equestrian Club. The center therapist in terms of mood, gate, abdominal width, and preparation and interest in receiving the necessary training evaluated the various horses of the equestrian club. The most suitable horse for therapeutic sessions among them was selected and, the horse's responses to the therapist's commands, handler, and interaction with the client were recorded during the sessions. At the equestrian club, a horse participated in hippotherapy sessions.

According to periodic examinations to participate in treatment programs, it was re-evaluated. This horse passed the necessary and basic training to participate in hippotherapy programs and had continuous training in this field. These exercises include preparing the horse for the presence of different people next to it and hearing different sounds that are made during the conversation between the therapist, the handler, and the client so that it does not surprise the horse. Another exercise was familiarizing the horse with the equipment used in each treatment session. First, the therapist teaches the children how to sit properly on the horse by following the safety tips. Then, he performs stretching exercises under the direct guidance and supervision of the therapist while the peers properly support the child. To increase the independence of children, the child

"actively" rides a horse. For example, he moves personally his foot from the horse or plays a significant role in riding from a chair on the horse's saddle, and through this method: therapeutic goals are met. The companion is always with the child and takes care of him in all the above steps. Hippotherapy was held for 10 sessions in 10 weeks according to the children's ability and the psychiatrist. In these sessions, not only the children rode horses but also they petted the horse before riding, talked to the horses, walked with horses, and visited the stables. Each session was about 45-60 minutes. The things that were done each session, in the same way, are: At the beginning of the sessions, explain the plans of the same session, change clothes, repeat the rules, recite poetry at the gate and observe hygiene (including washing hands and face and combing hair) and in the last three sessions, saying goodbye to the horse. In the table below, the specific intervention program for each session is presented **(Table 1)**.

Table 1. Dedicated Intervention Program for each Session of Hippotherapy

Number of sessions	Content of sessions
First session (Justification session)	Explain the relationship with the horse and introduce the horse as a friend. Visit the riding club environment and stables. Pet the horse to reduce fear and communicate. Explain safety issues and follow the rules: greet the horse, wash the hands after riding, bring a riding helmet In this session, parents will be interviewed about the .variables before the intervention in children with autism
The second session (Training and exercising)	- Learn how to sit on a horse. -Training how to get bridle. - Gate (horse walking) and riding exercises on horses.
The third session (Colored vase)	-Prepare colored vases in appropriate numbers and place them in different parts of the mange (riding ground). -Horse spiral movement in the Manege. It encourages the child to find the sequence of colored buckets. When reaching the buckets, the child throws the stone into the bucket while he is moving. Then he does the same for the next vase.
The fourth session (Catch the ball)	Prepare enough plastic balls. We throw the ball to the children on the horse from both sides so that the child can catch the ball in the air while keeping concentration and balance.
The fifth session (Stretching Exercise)	The equestrian instructor stands in the middle of the Manege. He gives the client stretching exercises for the arms, body, legs, and other exercises at his discretion, in addition to the first exercises.
The sixth Session (Feeding and treating horses)	In this session, to feed and treat the horse, the children went to the stables with the trainer after the horse gate for a certain period. They also had close and eye contact with their horse.
The seventh session (Match the image with objects on the ground)	We showed the child 5 pictures of objects or toys that we placed on the floor before. We asked the child to find them while he is riding a horse. After reaching to them, the companion held the object with a distance so that the child had to create tension in his body to take them.
The eighth Session (Horse steering by the client)	In this session, the clients got off the horse and steered the horse in different directions with the Handler after the gate. Then they introduced their horse to their parents and petted it. Children and parents will be reminded of the end of the sessions.
The ninth session (Goodbye)	. In this session, as in the second session, equestrian exercises were performed. - Children were given special exercises for right and left orientation. In this session, they said goodbye to the horses orally with petting.
The tenth session (closing)	There is no equestrian in this session. Children took souvenir photos individually and in groups with the horses. To distract children from riding, extracurricular activity such as group play and painting was also intended in this session, They interviewed parents about the changes after the intervention in children during oral therapy sessions

Results and Discussion

Data was analyzed after collecting. The results are shown in the **Table 2**.

Table 2 shows that the average age of the children was 10.62 years old with a standard deviation of 1.68. Seven children (87.5%) were boys and their duration of diagnosis was 6.5 with a standard deviation of 44.2. Among the children, five of them were (62.5%) the first child. The average age of their father was 53.62 years old with a standard deviation of 10.91 years. The average age of their mother was 48.75 years old with a standard deviation of 7.02 years. Five fathers of children (62.5%) had the university level. The mother of five children (62.5%) had the diploma level. It is also evident that a child in the family has an autism experience.

Table 2. Frequency Distribution of Individual Characteristics of Children with Autism

Personal information		
Age (years)	Standard deviation ± mean	10.62±1.68
	Maximum-minimum	8-13
Gender; (percentage) frequency	Girl	1(12.5)
	Boy	7(87.5)
Duration of diagnosis (years)	Standard deviation ± mean	6.5±2.44
	Maximum-minimum	3-10
Baby medicine	Risperidone medroxy	1(12.5)
	Thyroid medicine	1(12.5)
	Risperidone	2(25)
	Ritalin	2(25)
	Ritalin and risperidone	1(12.5)
	None	1(12.5)
Birth Rate; (percentage) frequency	1	5(62.5)
	3	1(12.5)
	4	2(25)
	Music	1(12.5)
	Painting, language, music	1(12.5)

Child treatments; (percentage) frequency	Painting	2(25)
	Painting, music	1(12.5)
	Painting, theater	1(12.5)
	None	2(25)
Father age; (percentage) frequency	Standard deviation ± mean	53.62±10.91
	Maximum-minimum	42-71
mother age; (percentage) frequency	Standard deviation ± mean	48.75±7.02
	Maximum-minimum	37-58
Father's education; (percentage) frequency	High school	2(25)
	Diploma	1(12.5)
	University	5(62.5)
Mother education; (percentage) frequency	Diploma	5(62.5)
	University	3(37.5)
History of autism	YES	1(12.5)
	NO	7(87.5)

Table 3 shows that, after the intervention, the average score of executive function and its dimensions are significantly lower than before the intervention, which indicates better executive function. It should be noted that only in terms of supervising this difference was not significant.

Table 3. Numerical Indicators of Executive Function of Children with Autism and Its Dimensions

Executive function and its dimensions	Wilcoxon test result	After		Before	
		Standard deviation	Average	Standard deviation	Average
Initiation	P=0.011	1.95	15.87	1.38	19.75
Active memory	P=0.012	3.77	22.25	2.19	32.37
planning	P=0.012	2.5	25.37	1.59	31.62
Organizing tools	P=0.017	3.77	16.75	1.3	22.37
Supervision	P=0.106	3.05	20.75	2.32	24
Metacognition index	P=0.012	6.11	101	4.79	130.12
Inhibition	P=0.012	1.3	18.62	2.06	28.38
The transfer	P=0.017	2.77	25.62	1.64	30.87
Emotional control	P=0.012	3.42	20.37	1.45	37.12
Behavior regulation index	P=0.011	3.88	64.62	2.92	96.37
Executive function.	P=0.012	8.1	165.62	5.5	226.5

Table 4 shows that, before the intervention, the behavioral problems of all children were high but they moderate after the intervention, and none of the children had low-level behavioral problems. It is also noticed that, after the intervention, behavioral problems were significantly fewer than before the intervention, which indicates fewer behavioral problems after the intervention ($p = 0.012$).

Table 4. Frequency Distribution, Average and Standard Deviation of Behavioral Problems in Children with Autism

Behavioral problems	Percentage	Frequency	percentage	Frequency
	After the intervention			
Middle	100	8	0	0
	Before intervention			
Top	0	0	100	8
Total	100	8	100	8
Standard deviation ± average	103.62±6.27		161.41±9.28	
Wilcoxon test result	**P=0.012**			

Conclusion

In this group intervention, the parameters before and after treatment were measured during 10 weeks of hippotherapy intervention, which was performed on 8 children with autism spectrum disorder aged 9 to 12 years. The results showed that hippotherapy improved behavioral problems and executive function in children with an autism spectrum disorder. In the present study, after the intervention, the average score of executive performance and its dimensions were significantly lower than the time before the intervention, which indicates better executive performance in the participating children. Hippotherapy reduces behavioral problems, behavioral regulation index, and generally executive function in children with autism spectrum disorder, according to the results of the present study. Executive performance indicators in children with autism and its dimensions show a significant decrease in parameters such as start, working memory, organizing tools, planning, metacognition index, inhibition, transmission, emotional control, and behavior regulation index.

On the other hand, the present study results show that after the intervention, participants showed moderate behavioral problems and children's behavioral problems were high before the intervention. In this case, none of the children showed behavioral problems at a minimal level. Therefore, to solve behavioral problems in children with an autism spectrum disorder in the age group of 9 to 12 years, hippotherapy is useful. In this regard, Kern *et al.* conducted the results of a study on children with autism spectrum disorder to investigate the effect of hippotherapy on their behavioral problems in 2015. It shows that after three months of riding, the severity of symptoms of autism spectrum disorder in the behavioral dimension decreases significantly. Most of the participants had severe levels of autism spectrum disorder in the study concerns to Kern *et al.* [20]. These results are the same as the present study results. In 2018, concerning this case, Gabriels *et al.* conducted a randomized clinical trial study entitled long-term effect of hippotherapy on teenagers aged 6-16 years with an autism spectrum disorder. 36 participants in the intervention group in this study were treated by hippotherapy for 10 weeks. They were followed and controlled for 6 months and were compared with the control group (28 people). The study results showed that hippotherapy is a complementary intervention in strengthening and improving the behaviors of children with autism and reduces irritating behaviors [21]. These results are also the same as the present study results. In this regard, Bass *et al.* conducted another study to investigate the effect of hippotherapy on the social functioning of children with autism in 2019. In this study, equestrian was performed for children with autism spectrum disorder for 16

weeks. The results showed that there is improvement in motor function as well as the social performance of the participating children [22]. Tan *et al.* conducted a study entitled Parents' Perceptions of Psychosocial Changes in Children with Autism Spectrum Disorder after Horse Participation in the Pediatric Treatment Process in 2018 [23]. In this study, they asked parents of children with an autism spectrum disorder to identify behavioral or developmental changes in children in a questionnaire who have experienced hypothyroidism in their children. The study results showed the improvement of children's self-concept and emotional well-being, the ability to express emotions, better social functioning of the child, and the reduction of parental supervision over their performance. These results indicate that regardless of the type of hippotherapy program, the partnership between horses and children with autism has a significant therapeutic effect on the executive performance of this group of children. Parents also explained that impartial understanding of horses also played an important role in the comfort and safety of children [23]. Dysfunction is one of the cognitive impairments of children with autism, according to recent evidence [24]. Executive performance is a cognitive domain and to perform complex behaviors and achieve a specific goal includes a multidimensional set of needed abilities. Executive dysfunction is shown in the form of unorganized activities, reduced initiative, difficulties in forming new concepts, and inhibition of inappropriate activities by people with autism [24]. In 2020, Fathabadi *et al.* performed a study entitled "the effect of rhythmic exercise movements on executive performance, behavioral limitations and memory of boys with autism with a study of 38 children with autism". They found that children with autism improved their performance, rhythmic limitations, behavioral limitations, and memory by performing rhythmic motor exercises after 6 weeks of intervention [25] Autistic children aged 8 to 12 years were participants in this study. These results are the same as the present study results. It is necessary to repeat the present study with more samples, due to the limitations of the present study, including the intervention for 10 weeks, which was performed for the condition of children and problems related to coordination with the relevant centers. The range of changes observed may be affected and become more remarkable if the hippotherapy sessions continue for a longer period. In general, contacting a horse and using it in the treatment process improves the emotions and performance of children with autism, based on the available evidence. Hippotherapy has a positive effect on the sensory characteristics of children with an autism spectrum disorder. Stereotyped movements are significantly reduced due to the relaxation provided by the horse's movements. It is important that children with autism feel safe and comfortable about themselves and what they are. Furthermore, it has been observed that hippotherapy increases a person's motivation and self-esteem. Therefore, equestrianism with clinical therapies can be a very effective method for people with an autism spectrum disorder.

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Conflict of interest: None

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