

Effects of Equine Assisted Therapy on Response Reaction Time and Attention Span of Youthswith Autistic Spectrum Disorder

Supattikorn Yotchukiat ^{1,*}, Maethisa Pongsaksri¹ & Siriporn Peansukmenee²

Department of Occupational Therapy,
Faculty of Associated Medical Sciences, Chiang Mai University

¹Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University

²Department of Companion Animals and Wildlife Clinic,
Faculty of Veterinary Medicine, Chiang Mai University

*Corresponding author: Supattikorn Yotchukiat
Email: Supat_tikorn @ hotmail.com

Abstract

The objectives of this research were to develop and investigate the effect of equine assisted therapy on the reaction time and attention span of youths with autistic spectrum disorder (ASD). This research was a quasi – experimental design. The participants in this study were 6 autistic youth aged 14–25 years. They were selected by purposive sampling. These participants participated in equine assisted therapy, twice a week, for a 4 week period. Each session took 80-90 minutes. The instruments of the pretest and posttest research outcome measures included 1) A multi choice reaction timer to measure reaction times of participants 2) a set of activities, consisting of a structured activity and semi-structured activities, to evaluate the attention span of participants. The Wilcoxon Signed-Rank Test showed that the duration and number of distractions were significantly decreased in both structured and unstructured activities, and reaction times were significantly quicker ($P < .05$). Therefore, equine assisted therapy is applicable for improving reaction times and attention spans of youths with autistic spectrum disorder.

Keywords : Equine Assisted Therapy, Youth with Autistic Spectrum Disorder, Attention, Reaction Time

Introduction

Persons whom are diagnosed as having Autistic Spectrum Disorder (ASD) have impairment in social and communication skills and in patterns of their behavior and interest (Diagnostic and Statistical Manual of Mental Disorders, fifth edition: DSM 5). People with ASD have limited interest. They pay attention and respond to stimuli inappropriately. They are rigid and perform repetitive behaviours (Volkmar, Rogers, Paul, Pelphrey, 2014). The number of people with ASD in Thailand has been reported to be around 370,000; and the incidence and prevalence of ASD in Thailand have increased. Department of Mental Health reports the incidence of 4.07 in 2555 (2012) and 4.67 in 2556 (2013). The report ranks ASD 8th among all diseases in the country (Department of Mental Health, 2013). ASD leads to limitations in performing occupations, e.g., social skills, communication, play, ability to perform activities of daily living (ADL), perception and learning, educational or vocational preparedness, and independent living skills. The role of occupational therapists in this client group is to prepare their clients through various therapeutic activities, in order for them to perform their occupations appropriately, according to their ages. Nevertheless, in recent years, a variety of therapeutic programs have been reported, for

example, music therapy, art therapy, and animal assisted therapy. Among these, the latter is getting more attention from the public as animals become an important part of improving physical and mental health, as well as human development (Solomon & O'Brien, 2011). Any animal can be selected for a therapy program. However, horses have become popular for this purpose, and such therapy is called hippo therapy or equine assisted therapy.

Humans and horses have a longstanding relationship from a long time ago. Horses have helped humans with travelling, communication, culture establishment, agriculture, commerce, and logistics. With their various roles, horses can be easily seen in public, while the science of horse riding has developed, and it eventually became a therapeutic media for improving human health. In Thailand, equine assisted therapy has been implemented in a treatment program for a group of special children since 2548 (2005) (Sirirutraykha, 2007). Much literature has reported the effectiveness of using equine assisted therapy on social, communication, and language skills (Gabrielsa et al., 2012; Bass, Duchowny & Llabre, 2009; Kunrungrisoromboon, Maneevong, & Boonsri, 2008; Kunrungrisoromboon, 2012); and also on improvement of the sensory integrative function, self-regulation and praxia, and decreasing hyperactivity (Bass, Duchowny & Llabre, 2009; Gabrielsa et al., 2012). Equine assisted therapy can also improve cognitive functions such as perception of shape, colour, and size of materials through activities, such as counting a horse's footprints or naming parts of a horse's body (Granados & Agis, 2011).

This study aimed to investigate the effectiveness of applying an equine assisted therapy program to youths with ASD, aged between 14-25 years. People of this age group have started to take full responsibility for themselves, both in educational and occupational aspects (Kaewkangwan, 2010). In addition, this study

aimed to investigate the two variables: response reaction time and attention span, since people with ASD often show limited interest in stimuli. They may choose inappropriate stimuli, or selectively pay attention to rough details, or stay focused very briefly on them; these may have an impact on their learning process and their living skills (Bogdashina, 2003). Studies about response reaction time suggest that the reaction time of individuals depends on their level of arousal. Individuals with an optimal arousal state will have rapid and precise responses to stimuli (Kosinski, 2013). An optimal arousal state enhances brain functions, so that individuals receive information effectively and respond to any stimulus appropriately. All in all, this study expected to design an equine assisted therapy program and investigate its effectiveness on response reaction time and attention span of youths with ASD. The results of this study would benefit and improve the capacity of this client group.

Objectives

1. To develop an equine assisted therapy program that would affect response reaction times and attention spans in youths with autistic spectrum disorder (ASD).
2. To investigate the effect of equine assisted therapy on reaction times and attention spans in youths with autistic spectrum disorder (ASD).

Terminology

Individuals with Autistic Spectrum Disorder refers to adolescents who show abnormal development in the following aspects: social interaction, speech and language, language comprehension, usage of language, communication, and restricted and repetitive behaviours. In this study, 14-25 years-old youths with ASD were recruited.

Reaction Time refers to the length of time,

in milliseconds, during which the presence of a stimulus and the initial movement of the subjects responded to the stimulus. The Multi Choice Reaction Timer, a timer for detecting eye-hand reaction or hand movement reaction to a visual stimulus, developed by Mr. Mongkol Wibulrangsarn, Head of Science Instruments, Electronics Division, Maharaj Nakorn Chiang Mai Hospital, was used in this study.

Attention Span refers to an individual's concentration while continually performing a sequential task. In other words, it is the ability of an individual to maintain attention when doing a task repeatedly and continuously without distraction from it. In this study, the attention span of the subjects was assessed through structured and semi-structured activities.

Equine Assisted Therapy refers to a therapeutic program using a horse as a therapeutic media. In this study, equine assisted therapy is based on the conceptual framework of animal assisted therapy and the sensory integrative frame of reference. The therapeutic program consists of four activities: introduction, preparation and feeding a horse, grooming a horse, and preparation and walking a horse. All four activities took a total of 80-90 minutes.

Frames of Reference and Conceptual Framework Used in the Study

1. Sensory Integrative Frame of Reference (SI)

The SI frame of reference explains an integration of sensory functions and the central nervous system. The SI frame of reference emphasizes three sensations from the tactile system, vestibular system, and proprioceptive system, which are essential for the development of adaptive responses. Equine assisted therapy can stimulate the three sensory systems of the research subjects. Through direction, speed and duration of riding, as well as rhythmic movement of the horses' body,

horse riding activities including walking a horse and positioning of individuals' bodies while grooming a horse, can stimulate all senses passing through muscles, tendons, joints, vestibular, and tactile systems (Smith, 2011). The proprioceptive system in the subjects' bodies can be stimulated through actions such as jerking or pulling a rope during the walking activity in order to control the horse's walking, and through actions such as pressing and rubbing the horse's hair during grooming. The tactile system in the subjects' bodies can be stimulated through many activities while taking care of an animal, for example, brushing its hair, or giving it a pat when greeting. Nevertheless, equine assisted therapy is regarded as an alternative among various therapeutic programs which are based on giving various kinds of sensory stimuli to the subjects. One cannot claim that equine assisted therapy is a direct application of the Sensory Integrative Frame of Reference (SI).

2. Conceptual Framework of Animal Assisted Therapy

Animal assisted therapy places an emphasis on, and believes in, the relationship between humans and animals. Crawford, Worsham & Swinehart (2006) explained that the relationship between humans and animals could lead to emotional bonding. A close relationship is developed through activities such as taking care of, and feeding an animal. Both humans and animals become companions, fulfilling a sense of security based on each another. Furthermore, some scientists viewed that animals can attract humans' interest but not arouse them. (Velde, Cipriani & Fisher, 2005).

Methods

The study design was a Quasi-Experiment.

Delimitation

Research population delimitation

Female and male youths with ASD aged between 14–25 years old.

Subjects

The subjects of this study were six female and male youths, aged between 14-25 years, diagnosed with ASD. Purposive sampling was used to recruit the research subjects.

Inclusion criteria

1. Participants must have been diagnosed with autistic spectrum disorder (ASD).

2. Participants must be able to communicate in Thai, comprehend conversations, and respond to others.

3. Based on history received from guardians, the participants must be able to start, continue, and finish activities on their own. For example, they must be able to take a bath sequentially and correctly. Task sequence and continuity of the subjects' performances were evaluated by the researcher.

4. Based on history received from guardians, the participants must have no other disorders, for example, epilepsy, asthma, or allergic conditions that could limit participation in the program.

5. The participants must give their assent and their guardians must give their consent, both voluntarily. Both parties need to sign an assent/ consent form.

6. The participants must not participate in other therapeutic programs during participation in this program, and their routine activities of daily living must be maintained without any change.

Exclusion criteria

Subjects were excluded if they refused to participate in the equine assisted therapy program, for example, if they refused to take part in activities involving a horse, or if they resisted following any procedure of the program.

Research Instruments

1. Equine Assisted Therapy Each subject participated in the equine assisted therapy program

twice a week, for 4 weeks, which made 8 sessions in total. Each session took 80-90 minutes. The program, consisting of 4 activities, took place on a daily basis, except Friday. Only two subjects participated each day. Details of the program are as follows:



Figure 1 : Approaching and greeting the horse

2. Preparing and feeding the horse (approximately 20 minutes)

Beginning by feeding the horse with straw, concentrates, water, and supplementary foods such as ripe bananas, apples, carrots, and corn, etc.



Figure 2 : preparing grass for feeding

3. Cleaning the horse (approximately 30 minutes)

Grooming a horse by using a 'Dandy brush', 'Curry comb' and 'Body brush', respectively. Then cleaning the horse's face.



Figure 3 : brushing the horse's hair

4. Preparing and walking the horse (approximately 30 minutes)

Putting on a harness, positioning one's body in order to walk, and then commanding the horse to start walking.



Figure 4 : the initial step of walking the horse

1. Introduction (approximately 10 minutes)

Introducing names of individual subjects, horses, and activities. Approaching and greeting horses. Explaining procedures and precautions.

2. The Multi Choice Reaction Timer This timer was used for timing the reaction time. The length of time (in milliseconds) from when the subjects first saw a flashlight until they pressed the button was measured, representing subjects' eye-hand reaction time. As indicated earlier, the multi choice reaction timer used in this study was developed by Mr. Mongkol Wibulrangsarn, Head of Science Instruments, Electronics Division, Maharaj Nakorn Chiang Mai Hospital.

3. Activities for Attention Span Evaluation Activities used for evaluating attention span consisted of two tasks: a structured task (sorting out buttons) and a semi-structured task (imitated drawing). Both tasks had been used to evaluate the attention span of patients with psychiatric symptoms (Siripraiwan, 2013) and also people with autism aged 8-22 years (Autistic Chiang Mai Association, 2013) As cognitive skills, memory function in particular, could have an impact on the test results, they needed to be delimited. Both tasks do not require language ability by the subjects, but through demonstration and practice, the subjects could understand both of the tasks. To raise motivation of the subjects, they were allowed to select a picture they wanted to draw and choose any color they wanted to use.

Statistics

Descriptive statistics, i.e. mean, median and quartile deviation were used to analyze the data. The Wilcoxon Signed-Rank Test, which uses non-parametric statistics, compared the reaction times and attention spans of the subjects before (pre-test) and after (post-test) participation in the equine assisted therapy program.

Results

Table 1: Gender and age of the subjects

Subjects	Gender (years)	Age age	Average	SD	Minimum age	Maximum age
1	Male	24				
2	Male	20				
3	Male	22	20.67	2.16	18	24
4	Male	19				
5	Male	21				
6	Female	18				

Table 2: Median and quartile deviation of reaction time, distraction time, and numbers of distraction of the subjects, Pre-test and Post-test

Variables	Before participation (Pre-test)		After participation (Post-test)	
	Median (Mdn.)	Quartile deviation (Q.D)	Median (Mdn.)	Quartile deviation (Q.D)
Reaction time (milliseconds)	1.21	0.39	0.78	0.25
Attention span: Structured activities				
• Distraction time (seconds)	0.19	0.09	0.06	0.05
• Number of distraction (times)	12	6.85	5	3.67
Attention span: Semi-structured activities				
• Distraction time (seconds)	0.20	0.20	0.04	0.03
• Number of distraction (times)	7	4.88	3	2.31

Table 3: Comparing Pre-test reaction time and Post-test reaction time

Variables	Assessment	Rank-		Rank+		Ties	Z	p
		N	Mean	N	Mean			
Reaction time	Pre-Post	6	3.50	0	0		-2.201	.028

*p<0.05

Table 3 Results yielded from the Wilcoxon Signed – Rank Test indicate that the Post-test reaction time was significantly less than the Pre-test reaction time with the statistical difference (p < .05).

Table 4: Comparing distraction time and numbers of distraction between Pre-test and Post-test

Variables	Assessment	Rank-		Rank+		Ties	Z	p
		N	Mean	N	Mean	N		
Structured activities								
• Distraction time	Pre-Post	6	3.50	0	0		-2.201	.028*
• Numbers of distraction	Pre-Post	6	3.50	0	0		-2.201	.028*
Semi-structured activities								
• Distraction time	Pre-Post	5	3	0	0	1	-2.023	.043*
• Numbers of distraction	Pre-Post	5	3	0	0	1	-2.023	.043*

*p<0.05

Table 4 Results yielded from the Wilcoxon Signed – Rank Test indicate that both the Post-test distraction time and the numbers of distraction were significantly less than those of the Pre-test with the statistical difference (p < .05).

Conclusion

The reaction time results indicate that the reaction times between Pre-test and Post-test showed a significant statistical difference at p < .05. This means that after participating in the equine assisted therapy program, the Post-test reaction time was less than the Pre-test reaction time, inferring accuracy and precision of the subjects’ reactions. Another result indicates that both the Post-test distraction time and the numbers of distraction were significantly less than those of the Pre-test with the statistical difference (p <

.05), meaning that, after participating in the equine assisted therapy program, the subjects showed less duration of time, as well as less numbers of distractive behaviors.

Discussion

The study of the effects of equine assisted therapy on response reaction time and attention span in youths with ASD could be regarded as developing an alternative therapy program, apart from the usual program found in Occupational

Therapy (OT) clinics. There are increasing numbers of reports about using animal assisted therapy by occupational therapists, and those reports state that animal assisted therapy encourages physical, social and emotional functions, as well as perception and cognition of clients (Delta Society, 2011). The equine assisted therapy program in this study was divided into four structured activities with clear procedures: Introduction, Preparing and feeding the horse, Cleaning the horse, and Preparing and walking the horse, which were relevant to task-performing patterns of people with ASD, progressing from a repetitive task, to a task with a specific goal, and then to a complex task (Brown et al., 1977). In doing these four activities, the research subjects had to focus on the tasks and maintain their attention span throughout the process. They had to attentively continue their tasks which could encourage their level of arousal and attention span. During the 'Introduction' activity, the subjects had to be attentive in order to listen to information and understand the content. During the "Preparing and feeding the horse" activity, they had to concentrate in order not to overflow the food containers. During the "Cleaning the horse" activity, they had to memorize methods and procedures, as well as keep their eyes on the horse's body while brushing. During the "Preparing and walking the horse" activity, the subjects had to be aware of the environment in front of them and control their own level of arousal. They also had to be aware of the horse's reactions. The results of this study are similar to the study of Bass et al. (2009) which found that SI functions of autistic children had been improved through a horse riding program. Other studies also reported the benefits of equine assisted therapy on increasing attention span (Gardner, 2009) (Bass, Duchowny & Llabre, 2009), decreasing hyperactivity and increasing self-regulation (Gabrielsa et al, 2012). Accordingly, the conceptual framework of animal assisted therapy places an emphasis on the

relationship between humans and animals, and views that animals can attract people's interest but lack causing a state of arousal in them, which results in improving people's attention spans and preventing them from living in their own little world (Velde, Cipriani & Fisher, 2005). By doing all activities in the equine assisted therapy program, individuals are encouraged to stay focused on performing their tasks. They participate with the horses through feeding, cleaning, and communication while walking the horses. This reflects on the individuals' attention, concentration, and memory functions (Urichuk & Anderson, 2003). Furthermore, characteristics of the activities in the equine assisted therapy program would encourage motivation of youths with ASD, in order to perform all the tasks smoothly and successfully (Bogdashina, 2003). For example, the self-esteem of youths with ASD could be encouraged by making sure that the horses ate all of the foods they had been fed; this acquired self-esteem would motivate the youths to continue and complete their tasks. Apart from that, animals are regarded as a key in the process of changing human behaviours, as people need to learn to express appropriate social interaction with animals (Urichuk & Anderson, 2003). Interaction with animals could be an opportunity for the youths to become interested in potential future occupations.

The results of this study indicated the effectiveness of using Equine Assisted Therapy as an alternative therapy program in improving attention span and response reaction time in youths with ASD. Occupational therapists could use this therapeutic program with their ASD clients.

Recommendations for further study

1. In order to generalize the research results, future study should consider an experimental research design in a bigger sample size. The research subjects should be divided into control and intervention groups. After the intervention, the

persistence of changed behaviors, if any, of the research subjects should be observed.

2. Other variables such as praxia, dexterity, eye-hand coordination and language should be investigated in further study. Other groups of clients, for example, youths with Down's syndrome or short attention span, should also be investigated in further study.

Clinical application

As an equine assisted therapy program can improve reaction times and attention spans of youths with ASD, the results of this study can be applied by occupational therapists or other professions. A therapeutic program given to youths with ASD should be varied; and the youths should be taken to an environment outside the clinic, as the actual environment could help encourage their independent living. They would learn to become less dependent on others, improve their self-regulation, try solutions in various life situations, as well as advance some fundamental skills such as attention span and response reaction time. Beyond a therapeutic outcome, an equine assisted therapy program could be regarded as vocational

preparation for youths with ASD, as they could become interested in animals and even practice for an animal farm career. As the recent application of equine assisted therapy in Thailand becomes widely known to the public, health professionals could apply this program to other groups of clients. However, there are three components which need to be considered: the horse, client, and therapist. The horse should be healthy, calm, and well-trained. For a client, his/her interest in animals, signs, symptoms, pathology, limitations, precautions, or diseases should be considered. Before starting the equine assisted therapy program, a therapist has to evaluate the clients, set goals, design and analyze activities, set the therapeutic plan, etc.; so that the program becomes appropriate for and specific to individual clients, leading to the effectiveness of the program.

Acknowledgement

The study researchers would like to express their appreciation for the participation of the subjects and their guardians, and for the collaboration of veterinary students, who are members of horse riding clubs at Chiang Mai University.

References

- Autistic Chiang Mai Association. (2013). The effect of music therapy on development in autism. Faculty of Medicine, Chiang Mai University. Chiang Mai, Thailand: Author.
- Ayres, A. J. (1989). *Sensory integration and the child*. Los Angeles, CA: Western Psychological Services.
- Bass, M.M., Duchowny. C. A., & Llabre, M.M. (2009). The Effect of Therapeutic Horseback Riding on Social Functioning in Children with Autism. *Journal of Autism and Developmental Disorders*, 39, 1261-1267.
- Berget, B., & Braastad, B. O., (2011). Animal-assisted therapy with farm animals for persons with psychiatric disorders. *Journal of Animal-Assisted Interventions in Mental Health*. Norway.
- Bogdashina, O. (2003). *Sensory Perceptual Issue in Autism and Asperger Syndrome*. New York: Jessica Kingsley.
- Cole, M.B., & Tufano, R. (2008). *Applied theories in occupational therapy: A practical approach*. Thorofare : SLACK Incorporated.
- Delta Society. (2011). What are animal assisted therapy and activities? Retrieved June 14, 2014 from <http://www.deltasociety.org/Document.Doc?id=10>.
- Department of Mental Health. (2013). Annual Report 2013. Retrieved January 7, 2014 from <http://www.deltasociety.org/Document.Doc?id=10> (in Thai).
- Gabrielsa, R. L., Agnewa, J.A., Holtb, K. D., Shoffnerc , A., Zhaoxinga, P., Ruzzanob, S., Claytona, G. H., & Mesibovd , G. (2012) . Pilot study measuring the effects of therapeutic horseback riding on school-age children and adolescents with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 6 (2), 578–588.
- Gardner, L.L.(2009). *Analysis of Hippotherapy Outcome Measures*. Unite States: University of St. Augustine for Health Sciences. Augustine, United States of America: Author.
- Granados, A.C., & Agis I.F. (2011). Why Children with Special Needs Feel Better with Hippotherapy Sessions: A Conceptual Review. *The journal of alternative and complementary medicine*, 17 (3), 191-197.
- Keawkungwal, S. (2010). *Developmental psychology in all age ranges: Adolescents to the elderly* (9th ed). Bangkok: Samrada, Thailand: Author.
- Kosinski, R.J. (2013). A Literature Review on Reaction Time. Retrieved October 17, 2013 from <http://biae.clemson.edu/bpc/bp/lab/110/reaction.htm>.
- Kunrungsrisomboon, K., Maneevong, A., & Boonsri, K., (2008). *Hippotherapy in Autism*. Bangkok: Department of Mental Health, Bangkok, Thailand: Author.
- Kunrungsrisomboon, K. (2012). The Effect of Hippotherapy on development in autism children. *Rajanukul Journal*, 27 (2), 45-53.
- Liss, M., Saulnier, C., Kinsbourne, D.F., & Kinsbourne, M. (2006). Sensory and attention abnormalities in autistic spectrum disorder. *Autism*. 10, 155-172.

- Masuri, M.G. (2011). The effect of Animal Assisted Therapy in improving attention among Autistic children. Retrieved October 30, 2013 from <http://ieeexplore.ieee.org/xpl>.
- Parham, L.D. (2002). Sensory Integration and Occupation. In A.C. Bundy, S.J. Lane, & E.A. Murray (Eds.), *Sensory Integration: Theory and Practice second edition*. United States of America: F.A.Davis. 413-434.
- Shirley, N. L. (1991). Hippotherapy. In A.C. Bundy, S.J. Lane, & E.A. Murray (Eds.), *Sensory Integration: Theory and Practice second edition*. United States of America: F.A.Davis. 350-353.
- Siriphaiwan, S. (2013). Pilot study of the effect of art activity on attention span in psychiatric patients. Chiang Mai: Chiang Mai University.
- Sirirutraykha, T. (2007). Alternative therapy in delayed development children. Bangkok: Kurusapa Ladprao.
- Smith, B., (2011). Hippotherapy: How a horse helps children with sensory processing disorders. *AANE Journal*. 9, 12-14.
- Solomon, J. W., & O'Brien, J.C. (2011). *Pediatric Skills for Occupational Therapy Assistants (3rd ed)*. New York: St.Louis.
- Sripetcharawut, S. (2012). Sensory Integration and Occupation . in Soisuda Vittayakorn (Ed.), *Sensory Integration frame of reference: Theory and Clinical Practice in Occupational therapy*, Chiang Mai : Nana.
- Urichuk, L., & Anderson, D. (2003). *Improving Mental Health through Animal – Assisted Therapy*. Canada: Chimo Project.
- Velde, B.P., Cipriani, J., & Fisher, G. (2005). Resident and therapist views of animal-assisted therapy: Implications for occupational therapy practice. *Australian Occupational Therapy Journal*. 52, 43-50.
- Volkmar, F.R., Rogers, S.J., Paul, R., Pelphrey, K.A. (2014). *Handbook of Autism and Pervasive Developmental Disorders*. United States of America: John Wiley & Sons. 3-23.
- Wong, Y. L., & Loh, W.Y. (2012). *Increasing Employability of Persons with Autism Spectrum Disorders*. Autism Resource Centre (Singapore).