

EFFECTS OF 4 WEEKS OF HORSEBACK RIDING ON ANXIETY, DEPRESSION, AND SELF ESTEEM IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

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Abstract

Background and Objective

There is no report on the effects of horseback riding on children with attention deficit hyperactivity disorder (ADHD). Therefore, the purpose of this study was to determine the effects of 4 weeks of horseback riding on anxiety, depression, self esteem, attention, and learning disorder in children with ADHD.

Materials and Methods

Subjects comprised a convenience sample of 10 children aged 10–12 years with ADHD and 10 children without ADHD. Horseback riding sessions were performed 2 times (40 minutes/day) per week for 4 weeks. Before and after the horseback riding program, we measured the children's anxiety, depression, self esteem, attention, and learning disorder. The pre-test and post-test scores were analyzed with repeated-measures analysis of variance.

Results

After participating in the 4-week horseback riding program, anxiety ($p = 0.013$), depression ($p = 0.007$), attention ($p < 0.001$), and learning disorder ($p < 0.001$) were significantly improved in the ADHD group compared to the normal group. However, self esteem was not significantly different between the 2 groups ($p = 0.096$).

Conclusion

These results indicate that the 4-week horseback riding program used in this study was very effective for significantly improving anxiety, depression, and attention in children with ADHD.

Key Words: *anxiety, depression, self esteem, attention, attention deficit disorder, horseback riding therapy*

Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder characterized by developmentally inappropriate levels of inattention, overactivity, distractibility, and impulsiveness, which manifest during childhood.¹ Recently, ADHD has become highly prevalent in school-aged children. According to the Centers for Disease Control and Prevention report in 2013, the number of children with ADHD was about 6.8% of the world population.²

In Korea, the number of children with ADHD is increasing, and special attention is required for its treatment and prevention. Based on a recent survey in Korea, about 7.2% (152,640) of students had symptoms of ADHD in the Student Emotional and Behavioral Problems Screening Test conducted in 2,139,243 elementary school, middle school, and high school students. Especially, among them, about 6,529 elementary school students were found to be in the high-risk group that urgently needed treatment.³

Studies on the improvement and treatment of ADHD symptoms have been performed in various ways. Some methods including cognitive treatment, behavioural (exercise) treatment, pharmacological treatment, and combinational treatment, etc. have shown positive results.⁴ It has been reported that animal-assisted therapy positively helps children with mental and physical disorders in physical, cognitive, and emotional ways.⁵ Horseback riding is a typical exercise that may improve emotional stability and healthy fitness by communing with a horse.⁶ Moreover, studies on the exercise or mental effects of horseback riding have

been conducted,⁷⁻⁹ but ones on the therapeutic effect in children with ADHD have not been reported yet.

Therefore, the purpose of this study was to analyze the changes in anxiety, sense of depression, and self esteem in children with ADHD who participated in a horseback riding exercise program for 4 weeks.

METHODS

Participants

In this study, 10 students who were diagnosed as having ADHD and 10 mentally healthy students who were selected from physically healthy male elementary school students participated in this experiment (Table 1). This study was approved by the Human Care and Use Committee of the Institute of Sports Science of Dongguk University. Subjects and their parents or guardian were informed of the procedures and provided informed consent before participation.

Study Design

Subjects' physical characteristics, the ADHD rating scale score, and learning disorder test results were obtained from the children's guardians, and information about depression, anxiety, and self esteem was obtained directly from the subjects. All measurements were performed before and after completing the 4-week horseback riding exercise.

Anthropometric Measurements

Subjects' height and weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, by using a stadiometer, digital electronic scale, and body mass index (kg/m²).

Table 1 Participants' Physical Characteristics

Group	n	Age (years)	Height (cm)	Weight (kg)	Body mass index (kg/m ²)
ADHD	10	10.3 ± 1.8	141.3 ± 4.5	41.9 ± 4.0	21.0 ± 1.7
Normal	10	11.2 ± 1.3	139.9 ± 4.8	41.4 ± 6.6	21.0 ± 1.9

Data expressed as a mean ± standard deviation.
ADHD = attention deficit hyperactivity disorder.

Assessment of ADHD, Anxiety, Depression, Self Esteem and Attention and Learning Disorders

The ADHD rating scale was developed by Dupaul et al.¹⁰ based on The Fourth Edition of the *Diagnostic and Statistical Manual of Mental Disorders*. It is useful for diagnosing ADHD and assessing the effectiveness of treatment since it is based on sex and age, and it is observed and written by parents and teacher. The ADHD Rating Scale-4 consists of 18 questions divided into inquiries about symptoms of attention deficit disorder, hyperactivity, and impulsivity. Each question is graded from 0 to 3, and ADHD was diagnosed when parents obtained a total score of 19 points and teachers obtained a total score of 17 points.

The Child Anxiety Scale is a children’s version of the Manifest Anxiety Scale for Adults developed by Taylor in 1953 and used as the Revised Children’s Manifest Anxiety Scale (RCMAS) by Reynolds and Richmond in 1978.¹¹ This scale, which is used to evaluate anxiety disorder, is composed of 37 questions in self-report form, and each question is answered as yes or no by children and adolescents. The total score is calculated, and higher scores indicate more severe anxiety symptoms; additionally, the symptoms related to various types of anxiety are evaluated.

The Center for Epidemiological Studies Depression Scale (CES-D)¹² developed by the United States Mental Health Research Institute for epidemiological

studies of depression was used to evaluate depression. This scale consists of 20 questions and is a self-report scale rated by 0 to 3 points. It can measure depression, guilt, feelings of selflessness, helplessness, hopelessness, delay of mental movement, loss of appetite, and sleep disorder. Additionally, it is used to compare the prevalence of depression among countries, ethnic groups, age groups, and between men and women. Scores range from 0 to 60, with a cut-off score of 21 for local epidemiology and a cut-off score of 25 for diagnosing major depression.

The Self Esteem Scale (SES) developed by Rosenberg in 1965 was used to assess self esteem,¹³ and the self-report questionnaire consisted of 5 items of positive and negative self esteem. A high score on the 4-point scale was diagnosed as a high self esteem.

The learning disorder test was conducted by the parents as a measure to assess the degree of learning disorder. Seventeen items were marked as not at all present, slightly present, fairly present, or very significant, and the total was recorded. Generally, more than 10 points of fairly present or very significant are likely to indicate a learning disorder.

Horseback Riding Program

The rehabilitative horseback riding program used in this study was modified and supplemented based on the program used by the American Equestrian Therapist Association¹⁴ and the youth equestrian

Table 2 Details of the Rehabilitative Equestrian Program

	Time	Description	Other
Getting ready	5 minutes	Wear safety equipment (a safety vest and helmet)	
		Say hello to the horse	
		Stroke the horse	
Horseback riding	30 minutes	Warm-up Main exercise Cool-down	Learn a riding skill by phase and level 8 times
Organize	5 minutes	Stroke the horse	
		Dismount from the horse	
		Say goodbye to the instructor and assistant	
		Take off safety equipment	

program designed by the Korea Racing Authority. The basic framework is shown in Table 2. The frequency of participation was 4 weeks, twice per week for no more than 40 minutes, which included the preparation time from the start to finish.

Statistical Analysis

Descriptive variables are presented as a mean \pm standard deviation. Data analysis was performed using 2×2 repeated-measures analysis of variance. Statistical significance was set at $p < 0.05$. SPSS 21.0 (SPSS Inc., Chicago, IL, USA) was used to perform all analyses.

RESULTS

The anxiety score before and after the 4-week horseback riding program decreased from 20 to 16.9 points in the ADHD group, and this was statistically significantly different compared to the normal group ($p = 0.013$) (Table 3). The depression score before and after the 4-week horseback riding program decreased from 18.4 to 13.1 in the ADHD group, and this was statistically significantly different compared to that in the normal group ($p = 0.007$). The self-esteem score before and after the 4-week horseback riding program in the ADHD group increased from 30.1 to 31.8; this was not statistically significantly different compared to that in the normal group. The attention total score

before and after the 4-week horseback riding program in the ADHD group decreased from 28.4 points to 22.8 points. The attention deficit component of the ADHD score decreased from 16.2 to 13.4 points, and the hyperactivity/impulsivity score decreased from 12.2 to 9.4 points; these findings were statistically significantly different compared to those of the normal group ($p < 0.001$). The learning disorder score before and after the 4-week horseback riding program decreased from 30.2 to 27.2 in the ADHD group, and this was statistically significantly different compared to that in the normal group ($p < 0.001$). However, self esteem was not significantly different between the 2 groups ($p = 0.096$).

DISCUSSION

The result of the RCMAS test, which was used to evaluate anxiety before and after rehabilitative horseback riding in this study, decreased from 20 to 16.9 points. This result suggests that the exercise can be used as an intervention program to reduce the problematic behaviours of children with ADHD.¹⁵ Performing rehabilitative horseback riding improved anxiety. This effect seems to be the result of experiencing less anxiousness when interacting with an animal, confidence in that they can move on a horse, self-efficacy in that they can horseback ride, and the sense of accomplishment.

Table 3 Changes in ADHD Variables after the 4-Week Horseback Riding Program

Variable	Group	n	Pre-test	Post-test	Interaction (time \times group)	
					F	p-value
Anxiety	ADHD	10	20.0 \pm 5.8	16.9 \pm 5.2	7.661	0.013*
	Normal	10	16.8 \pm 8.4	15.6 \pm 7.0		
Depression	ADHD	10	18.4 \pm 8.1	13.1 \pm 6.1	9.430	0.007**
	Normal	10	12.3 \pm 7.9	11.8 \pm 7.2		
Self Esteem	ADHD	10	30.1 \pm 5.8	31.8 \pm 4.5	3.093	0.096
	Normal	10	34.4 \pm 1.9	35.1 \pm 2.1		
Attention	ADHD	10	28.4 \pm 9.7	22.8 \pm 11.0	4.826	<0.001***
	Normal	10	9.5 \pm 5.9	9.0 \pm 5.3		
Learning Disorder	ADHD	10	30.2 \pm 5.1	27.2 \pm 5.1	18.409	<0.001***
	Normal	10	22.7 \pm 4.5	21.9 \pm 4.0		

Data are expressed as a mean \pm standard deviation.

ADHD = attention deficit hyperactivity disorder

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, tested by repeated-measures analysis of variance

In the CES-D test for depressive symptoms, the score decreased from 18.4 to 13.1 points. Archer and Kostrzewa¹⁶ reported a relationship between regular exercise and decreased depression, and that state anxiety can be effectively reduced with physical exercise. Bowers and McDonald¹⁷ reported that adolescents with severe emotional disturbances described a decrease in depression after a rehabilitative horseback riding program. Iannuzzi and Rowan¹⁸ found that adolescent exercise decreased psychological depression and improved quality of life. Similar to previous studies, this study also showed that the performance of short-term rehabilitative horseback riding decreased depression. This decrease in depression was due to the improvement of self esteem through special experiences of working with and communicating with horses, and sharing special empathy,¹⁹ the relative reliance of not being alone, and improvement of happiness through skin contact with animals. However, before and after the rehabilitative horseback riding program, the experimental group and control group showed a statistically significant positive effect on the CES-D test result. However, the results of the CES-D test were not significant. Therefore, it was confirmed that participants' depression in this study was not a cause for concern.

In the SES test for self esteem, the score tended to increase from 30.1 to 31.8. A previous study reported that regular exercise was associated with a decrease in depression and anxiety, as well as an improvement in self esteem.²⁰ However, the present study did not show any statistically significant results, suggesting that the application of short-term rehabilitative horseback riding may have affected the results.

The children who met this study's criteria were generally sensitive to the mood and changes in the program environment. During each session, participants were asked questions about the horse that they would ride on, and they were curious about the condition of the horses and were surprised or even afraid of the horse's small, unexpected movements. Participants were afraid of the horses, which were bigger than them, but the children's interest in horses increased. Thus, after they finished their educational classes, they approached the horses first, stroked them and

fed them, and described their experience afterward. We observed participants overcome their fear gradually in unexpected situations because they began to trust the riding staff and concentrated on the program activities. This result suggests that emotional stability was achieved through interaction with a horse, and physical activity had a positive impact on other social functions.

In this study, the attention deficit score of the ADHD group decreased from 16.2 to 13.4 points on the subsection score of the ARS test in the assessment of the concentration of attention before and after short-term rehabilitative horseback riding. This result supports that rehabilitative horseback riding, which had a positive effect on ADHD children's attention as a psychological exercise, improves individual performance through physical activity and social functioning,²¹ and aerobic exercise improves the attention deficit disorder.²⁰ Unlike previous studies, just participating in the short-term rehabilitative horseback riding program showed a positive result in the improvement of the attention deficit disorder.

The learning disorder score decreased from 30.2 to 27.2. This result supports that of Iannuzzi and Rowan's¹⁸ study, in which the riding exercise positively affected the quality of life of adolescents, and that of Hong and Yoon's²² study, in which psychotherapy was performed with a horse, making self-control and the management of behaviour possible through a non-verbal relationship with horses. We consider that this improvement of a learning disorder induced the learning effects because of the instinct to solve difficulties in new experiences through knowledge acquisition. Additionally, the horseback riding, which was once considered dangerous and difficult, became possible to perform because we induced children's interest in learning by building their confidence and sense of accomplishment. We heard that the parents of the children who participated in our study were delighted to talk about their children's changed attitudes in daily life at the end of this study; other academic guidance teachers also perceived the change in these children since they were interested and concentrated on this study more than any other therapies.

We believe that short-term rehabilitative horseback riding for children with ADHD has enough elements to enhance their attention through the very special experiences of working with horses and developing a relationship with them.

The limitation of this study was that it did not analyze the change in physiological variables of children with ADHD. However, improvement of psychological variables is very meaningful for children with ADHD.

CONCLUSIONS

We consider that the rehabilitative horseback riding program conducted in this study was able to improve the anxiety, depression, concentration of attention, and learning ability of children with ADHD, although it was only in the short term. This study's results show that there is a need to apply the equestrian training program to children with ADHD. For effective ADHD treatment, a horseback riding training program should be included.

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