**Original Article**

# Facilitation of social and interpersonal behaviors of children with pervasive developmental disorders through psycho-educational horseback riding

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**Abstract** : We have reported that during horseback riding activity, children with pervasive developmental disorders (PDD) showed enhanced verbal and nonverbal communication skills, and became more expressive in their positive and pleasant emotions in interaction with parents. In order to find out whether these positive behavioral effects of psycho-educational horseback riding (PEHR) will be maintained in their daily living situation, we conducted a questionnaire survey of the parents whose children rode horses. As the control group, we also used the same questionnaire to survey the parents of children who did not take part in the horseback riding. A significant difference was found between the two groups in several behavioral problems showing that PDD children who experienced PEHR became more emotionally stable, more patient, less apt to panic, and more skillful in interacting with their friends than PDD children in the non-PEHR group. Further, another significant difference was found between the two groups in several communication abilities showing that PDD children who experienced PEHR could play more easily in more difficult social situations, respond better to the verbal approach of parents, be more expressive in showing their own will or desire, and understood verbal instruction better than PDD children in the non-PEHR group. Therefore, it is suggested that the effect of PEHR may be maintained to a certain degree in the daily living situation. The importance of a positive field of emotion was suggested for maintaining these effects observed in PDD children experiencing PEHR.

Key words : Pervasive Developmental Disorders, children, communication, Animal-assisted therapy, horseback riding, positive field of emotion

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## 1. Introduction

Pervasive developmental disorders (PDD) are characterized by qualitative abnormalities in reciprocal social interactions, patterns of communication, and by a restricted, stereotyped, repetitive repertoire of interests and activities in ICD-10 by the World Health Organization (World Health Organization, 2009). These children perform very poorly in establishing interpersonal relationships with others, and as a result, they encounter difficulties in their daily social living activities. Although the scientific findings of the genetic (Muhle et al., 2009), biochemical (Whitaker-Azmitia, 2004) or neuropathological (Herbert et al., 2005) features of PDD have been described, and no established treatment has been widely accepted for this disease, various kinds of psycho-educational supports such as

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TEACCH (Panerai et al., 2002), behavioral therapy (Eldevik et al., 2006), sensory integration therapy (Schaaf and Miller, 2005), music therapy (Stephens, 2008), and milieu therapy (Mancil, 2009) have been reported to have some positive effects in facilitating the social skills of these PDD children and enhancing their quality of life.

Thus, many parents advocate for psychological and educational supports to facilitate the communicational skills of their children during the pre-school and school age period (Charman, 2005).

Recently, animal-assisted education and therapy have been reported to be very effective in facilitating the social and interpersonal behaviors of PDD children (Martin and Farnum, 2002). Horseback riding in which a horse is used as an assisting animal, was also found to be remarkably effective in facilitating the social and interpersonal behaviors of these PDD children (Leitão, 2003).

We have been especially supporting children through our unique psycho-educational horseback riding (PEHR) program that aims to improve the behavioral problems of these children. These children have shown apparent improvement in their interpersonal behaviors during their horseback riding trials in an arena (Keino et al., 2007). Interestingly, meaningful words were spontaneously spoken by PDD children who previously had no apparent verbal language after they participated in the new PEHR program designed to facilitate their verbal communicational ability (Keino et al., in press). However, it is not clear whether the social and communicational effects are limited to only during the horseback riding session or the positive effects or positive influence can be maintained in the daily living activities of PDD children.

In this study, we conducted a questionnaire survey in which the parents were asked about their awareness of the behavioral changes of their children in their daily living situation before and after the PEHR had been introduced.

## 2. Material and methods

The basic procedure of PEHR is composed of 2 sessions. Each session involves three laps around the riding circle. During the first session, the horse walks all the way around the first lap and slowly trots during the second and third laps. The child then takes a short rest before remounting for the second session. During the rest, the child is allowed to observe the horseback riding of his friends or to spontaneously help with the PEHR of his/her friends so as to experience the joy of helping behavior. During the second session, the horse walks or trots according to the child's request during the first and second laps. The child was allowed to play some favorite games while riding horseback and the third lap of the second session ended with the horse trotting, which most PDD children liked.

The PEHR program (Keino et al., 2007) composed of 10 sub-programs was introduced in order to reduce the occurrence of behavioral problems among these PDD children. Basically, the application of the PEHR program for each child was the same, but subtle changes or modifications to the program were arranged so that it properly fit the comprehension level, level of establishment, and the interest vectors of each child. Another PEHR program was also introduced which was specifically aimed at facilitating both verbal and nonverbal communication (Keino et al., in press).

## 3. Horses

The horses used in the PEHR program were a Kiso horse (Natsuka: age 10, height 138 cm) and a Haflinger (Arthur: age 11, height 148 cm). PEHR with the Kiso horse took place along a riding path (12 x 20 m) and another session performed using the Haflinger horse was conducted along a neighboring riding path (23 x 35 m). Both horses were well-trained therapy horses. The activity of both horses in the PEHR program was carefully restricted to within 2 hours per day, and behavioral and physiological stress signs of the horses were carefully checked by the horse keeper during the PEHR program. The horses were allowed to roam freely on the farm (about 45 x 70 m) during the rest of the day so that they might undergo the least amount of stress in their daily living situation.

Nineteen PDD children rode horseback while the horse was led by the leader. One or two side-walkers strode alongside the horse to provide support for the child under the supervision of the horse therapist. Four children at an advanced stage who could control the horse by themselves rode on the Haflinger under the supervision of the horse therapist.

## 4. Questionnaire survey

A questionnaire was prepared for the parents whose children attended the PEHR (PEHR group). As a

control group, we also provided the same questionnaire to the parents whose children did not attend the PEHR (Non-PEHR group). The PEHR group consisted of 22 children (19 boys and 3 girls), ranging in age from 4 years and 10 months to 16 years and 0 month (average: 9 years and 11 months) at the time of the questionnaire survey (Table 1a). The length of their horseback riding experience varied from 1 to 81 months (average: 39 months). The non-PEHR group consisted of 30 children (22 boys and 8 girls), ranging in age from 5 years and 11 months to 19 years and 2 months (average: 10 years and 8 months) at the time of the questionnaire survey (Table 1b).

One or two friends with no horseback riding experience were selected as a non-PEHR group for each PEHR child. The children of the non-PEHR group experienced the same daily educational and caring activities in school except for their lack of horseback riding experience compared with children in the PEHR group. Each mother of a PEHR group member was asked to retrospectively recall behaviors of her child at the time just before he/she started horseback riding and to evaluate the present behaviors of her child compared with his/her past behaviors according to

**Table 1a** Sex, age and length of horseback riding experience of PDD Children in PEHR group

| | Sex | Age | Length of horseback riding experience (months) |
|---|---|---|---|
| 1 | f | 6 yrs 1 month | 1 |
| 2 | m | 9 yrs 6 months | 1 |
| 3 | m | 7 yrs 7 months | 2 |
| 4 | m | 4 yrs 10 months | 9 |
| 5 | m | 6 yrs 8 months | 14 |
| 6 | m | 11 yrs 2 months | 26 |
| 7 | m | 10 yrs 8 months | 26 |
| 8 | m | 10 yrs 8 months | 26 |
| 9 | m | 7 yrs 1 month | 28 |
| 10 | m | 9 yrs 6 months | 28 |
| 11 | m | 10 yrs 10 months | 41 |
| 12 | m | 11 yrs 3months | 43 |
| 13 | m | 9 yrs 9months | 47 |
| 14 | m | 9 yrs 8months | 50 |
| 15 | m | 8 yrs 4 months | 51 |
| 16 | m | 13 yrs 3 months | 62 |
| 17 | f | 9 yrs 3 months | 64 |
| 18 | f | 8 yrs 8months | 64 |
| 19 | m | 15 yrs 1month | 69 |
| 20 | m | 16 yrs 0 month | 71 |
| 21 | m | 13 yrs 7months | 78 |
| 22 | m | 13 yrs 6 months | 81 |

Age: mean=10 years and 2 months

Length of horseback riding experience: mean=39 months

**Table 1b** Sex, age and length-matched months of PDD children in non-PEHR group equivalent with PEHR group

| | Sex | Age | Length-matched months of non-PEHR group equivalent with PEHR group (months) |
|---|---|---|---|
| 1 | m | 6 yrs 4 months | 1 |
| 2 | m | 7 yrs 7 months | 1 |
| 3 | m | 8 yrs 2 months | 1 |
| 4 | m | 8 yrs 7 months | 1 |
| 5 | m | 9 yrs 1 month | 1 |
| 6 | m | 12 yrs 4 months | 2 |
| 7 | m | 5 yrs 11 months | 3 |
| 8 | m | 9 yrs 6 months | 9 |
| 9 | m | 10 yrs 9 months | 9 |
| 10 | f | 11 yrs 2 months | 9 |
| 11 | f | 9 yrs 0 month | 12 |
| 12 | f | 7 yrs 0 month | 14 |
| 13 | f | 7 yrs 7 months | 14 |
| 14 | m | 19 yrs 2 months | 26 |
| 15 | m | 6 yrs 7 months | 26 |
| 16 | f | 10 yrs 5 months | 26 |
| 17 | m | 11 yrs 9 months | 26 |
| 18 | m | 12 yrs 3 months | 50 |
| 19 | m | 11 yrs 6 months | 51 |
| 20 | f | 8 yrs 5 months | 64 |
| 21 | m | 11 yrs 3 months | 64 |
| 22 | m | 7 yrs 1 month | 64 |
| 23 | m | 12 yrs 8 months | 64 |
| 24 | f | 14 yrs 6 months | 64 |
| 25 | m | 13 yrs 2 months | 68 |
| 26 | f | 16 yrs 1 month | 68 |
| 27 | m | 14 yrs 3 months | 71 |
| 28 | m | 15 yrs 5 months | 71 |
| 29 | m | 8 yrs 4 months | 78 |
| 30 | m | 16 yrs 1 month | 78 |

Age: mean=10 years and 8 months.

Length of horseback riding experience: mean=35 months

"How mother feels about her child's behaviors now." The length of time (months) during which the retrospective behavioral observation was done by each mother of a PEHR group child was carefully matched to that of his/her non-PEHR friends. The length-matched months of non-PEHR group equivalent with the PEHR group varied from 1 to 78 months (average: 35 months). Each mother of a non-PEHR group child was asked to recall the past behaviors of her child over the same number of months with that of the paired PEHR group. She was also asked to evaluate both the past and present behaviors of her child in the same way that a PEHR group mother did.

The questionnaire was composed of 10 questions concerning PDD children behavioral problems (Table 1a) and another 10 questions about the communication ability of the PDD children (Table 1b). Each question has 5 different choices (1: very much worse, 2: worse, 3: no change, 4: better, 5: very much better). A grade point was given to each choice: 1 point for choice 1, 2 points for choice 2, 3 points for choice 3, 4 points for choice 4, and 5 points for choice 5. The rating points were calculated and tested using the Mann-Whitney U test.

## 5. Ethical approval and informed consent of subjects

This study has been approved by the Ethics Committee based on the ethical rules established by the Institute for Developmental Research, Aichi Human Service Center. The horses used in this study were carefully raised under conditions in accord with the law of animal welfare and administration.

A detailed procedure of the PEHR program, contents of the present study, and possible risks such as falling from the horse that might occur while riding were carefully explained by the experimenters to all parents before the start of the study. All parents gave informed consent in writing for the participation of their children as subjects and to their own participation in answering the questionnaire survey in this study and the publication of the study results.

## 6. Results

Among the 10 questions concerning behavioral problems of the PEHR group with the shorter period of horseback riding experience (less than 18 months), responses to 9 questions (excluding No. 10: Does he/she have difficulty getting along with his/her friends?) showed no significant difference between the PEHR and non-PEHR groups (Table 2a).

However, in the comparison between the PEHR group with the longer period of horseback riding experience (more than 18 months) and the non-PEHR group, replies to questions such as No. 7 (Does he/she easily panic?), No. 8 (Does he/she patiently await his/her turn?), and No. 10 (Does he/she have difficulty getting along with his/her friends?) showed significant differences between the two groups (Table 2a).

As to the communication ability of the PDD children, no statistical difference was found among replies to any of the 10 questions between the PEHR group with less horseback riding experience (less than 18 months) and the non-PEHR group. However, a significant difference was found between the PEHR group with longer horseback riding experience (more than 18 months) and the non-PEHR group. Especially, two questions such as No. 19 (Does he/she understand verbal instructions?), and No. 20 (Does he/she successfully express his/her own feeling through facial expression?) showed clear and significant difference ($p < 0.01$) in responses between the two groups (Table 2b).

## 7. Discussion

PDD children have difficulty coping with changes in their natural and/or social environmental stimuli, and they show extreme resistance to these changes (Gomot et al., 2005). However, a subtle and well-prepared change may be accepted with no resistance by these PDD children. For example, we introduced a card game or dice game in which the change is purely mathematically determined. During our PEHR program, the kind of game actually played was chosen according to the number of the thrown dice, and the number could not be predicted by anyone. Although the PDD children panicked at first due to the unpredictability of the dice, they gradually became accustomed to the change in the number since they gradually learned that a small change in the dice game did not bring about any harmful result. This experience during the PEHR program may have produced some tolerance in the PDD children to the subtle change, and, hence, resulted in a positive influence upon their behavior in relation to the environmental change outside of the horseback riding track.

Social and communicational ability in cases of high

**Table 2a** Parents' evaluation of child behavioral problem in two groups

| | Length of horseback riding experience (less than 18 months) | | | Length of horseback riding experience (more than 18 months) | | |
|---|---|---|---|---|---|---|
| Questions regarding behavioral problems | PEHR group Mean ± SD | Non-PEHR group Mean ± SD | Mann-Whitney U | PEHR group Mean ± SD | Non-PEHR group Mean ± SD | Mann-Whitney U |
| 1. Is he/she nervous about smells? | 3.2 ± 0.4 | 3.0 ± 0.4 | 27 | 3.1 ± 0.4 | 3.2 ± 0.4 | 129 |
| 2. Does he/she tend to harm him/herself or others? | 3.2 ± 0.4 | 2.9 ± 0.3 | 24 | 3.4 ± 0.6 | 3.4 ± 0.6 | 129 |
| 3. Does he/she show irritation such as covering his/her ears on hearing strange sounds? | 3.2 ± 0.4 | 3.0 ± 0.0 | 26 | 3.2 ± 0.5 | 3.2 ± 0.5 | 145 |
| 4. Does he/she hate being touched by somebody? | 3.0 ± 0.0 | 3.1 ± 0.3 | 30 | 3.3 ± 0.5 | 3.1 ± 0.3 | 119 |
| 5. Does he/she persist in his/her own way or aberrant retualized behavior? | 3.2 ± 0.4 | 3.1 ± 0.3 | 29 | 3.5 ± 0.6 | 3.2 ± 0.5 | 113 |
| 6. Can he/she easily get over obsessive affections or emotions? | 3.4 ± 0.5 | 3.0 ± 0.4 | 21 | 3.7 ± 0.5 | 3.4 ± 0.7 | 114 |
| 7. Does he/she easily panic? | 3.2 ± 0.4 | 3.1 ± 0.5 | 29 | 3.6 ± 0.6 | 3.1 ± 0.6 | 81* |
| 8. Does he/she patiently await his/her turn? | 3.2 ± 0.4 | 3.2 ± 0.4 | 32 | 3.9 ± 0.5 | 3.4 ± 0.6 | 81* |
| 9. Does he/she move around impatiently and restlessly? | 3.4 ± 0.5 | 3.0 ± 0.0 | 20* | 3.8 ± 0.5 | 3.4 ± 0.5 | 99 |
| 10. Does he/she have difficulty getting along with his/her friends? | 3.2 ± 0.4 | 3.0 ± 0.0 | 26 | 3.6 ± 0.5 | 3.1 ± 0.5 | 82* |

*p＜0.05, **p＜0.01

functioning autism reportedly improved when peer-mediated social skill training was introduced (Chung et al., 2006). Helping behaviors of the intellectually disabled (ID) toward peer ID people with autism have been reported to be effective in improving the independent and self-determined behaviors of the ID and the ID with autism (Funahashi, 2000). Besides the positive influence of peers, parent training can successfully contribute to improving child communicative behavior, increased maternal knowledge of autism, enhanced maternal communicational style and parent-child interaction, and reduced maternal depression (McConachie and Diggle, 2007). Thus, in the present study, we introduced parent-child interaction as much as possible in the PEHR program. Parents were encouraged to respond by calling their child's name and appealing with physically pleasant gestures every time the child expressed his/her feeling through verbal or non-verbal communicational signs to his/her parents. Through this approach, the PDD child can learn that there is no harmful stimuli that might irritate his/her psychological field of emotion when he/she wants to express feelings and emotions during the PEHR program.

In general, there may be a lack of spontaneity in seeking to share enjoyment, interests, or achievements with other people, and there may also be a lack of social or emotional reciprocity in PDD children (Mental Health Professionals in the United States, 2007). However, as the PEHR program proceeded in this study, the PDD child experienced a stable, peaceful, non- harmful, and non-threatening environment on the horseback riding track. The recognition of their environment, which changed from being "harmful" to "pleasant," is a very important factor in aiding PDD children to courageously seek to spontaneously share enjoyment, interests, or achievements with parents and later with significant others. The PDD children also

**Table 2b** Parents' evaluation of communication ability of their child in two groups

| | Length of horseback riding experience (less than 18 months) | | | Length of horseback riding experience (more than 18 months) | | |
|---|---|---|---|---|---|---|
| Questions regarding behavioral problems | PEHR group Mean ± SD | Non-PEHR group Mean ± SD | Mann-Whitney U | PEHR group Mean ± SD | Non-PEHR group Mean ± SD | Mann-Whitney U |
| 11. Does he/she have strong likes and dislikes? | 3.2 ± 0.4 | 3.2 ± 0.4 | 31 | 3.2 ± 0.4 | 3.0 ± 0.3 | 121 |
| 12. Can he/she play any "Win or Lose" game with friends? | 3.0 ± 0.0 | 3.2 ± 0.4 | 28 | 3.4 ± 0.5 | 3.2 ± 0.4 | 111 |
| 13. Does he/she make eye-to-eye contact with others? | 2.8 ± 0.8 | 3.2 ± 0.6 | 24 | 3.6 ± 0.6 | 3.4 ± 0.5 | 116 |
| 14. Does he/she tend to point his/her finger at others? | 3.2 ± 0.4 | 3.1 ± 0.3 | 29 | 3.4 ± 0.5 | 3.2 ± 0.4 | 119 |
| 15. Does he/she play "Cowboy and Indians"? Does he/she play "School"? | 3.0 ± 0.0 | 3.1 ± 0.3 | 30 | 3.5 ± 0.5 | 3.2 ± 0.5 | 98 |
| 16. Does he/she respond to verbal approaches by his/her parents? | 3.2 ± 0.4 | 3.2 ± 0.6 | 32 | 3.8 ± 0.6 | 3.4 ± 0.5 | 88* |
| 17. Does he/she play with other children? | 3.2 ± 0.4 | 3.1 ± 0.3 | 29 | 3.5 ± 0.5 | 3.1 ± 0.5 | 90* |
| 18. Does he/she express any sign of his/her own will or desire? | 3.4 ± 0.5 | 3.2 ± 0.6 | 23 | 3.7 ± 0.5 | 3.3 ± 0.6 | 91* |
| 19. Does he/she understand verbal instruction? | 3.2 ± 0.4 | 3.2 ± 0.6 | 32 | 3.9 ± 0.4 | 3.4 ± 0.5 | 65** |
| 20. Does he/she successively express his/her own feeling through facial expression? | 3.2 ± 0.4 | 3.2 ± 0.6 | 29 | 3.8 ± 0.4 | 3.2 ± 0.4 | 68** |

*$p < 0.05$, **$p < 0.01$

learn that they are free to express their own feelings and emotions and that emotional reciprocity with parents can always be accepted with pleasant feelings expressed by parents and other people participating in the PEHR program.

Meinersmann (2008) proposed a hypothesis that participation in equine-facilitated psychotherapy with adult female survivors of abuse would result in increased self-esteem, self-efficacy, and feelings of empowerment, as well as decreased anxiety and depression.

In this study, we found that social and communication behaviors were improved in PDD children after participating in the PEHR program and that this behavioral improvement was maintained fairly well in their daily living situation, such as in interpersonal activity with family members at home.

A theoretical basis for this phenomenon is presented in a study on musical empathy (Funahashi and Carterette, 1985). Application of this hypothetical model of "empathy to music" to the cognitively interpreted "positive field of emotion" of PDD children in the PEHR program is very important for the improvement of social and communication abilities.

Once the positive (pleasurable) field of emotion was established, PDD children adopted a new strategy of changing their cognitive and emotional evaluation of new stimuli. Thus, PDD children regarded the new stimuli as non-harmful and non-threatening. As a result, PDD children experiencing PEHR may try to spontaneously share enjoyment, interests, or achievements, and social or emotional reciprocity with parents. In fact, the severe PDD children in the PEHR program who had not successfully established an interpersonal relationship may develop first an intimate relationship with the horse rather than people. They then gradually establish interpersonal relationships with people (the leader and the side walkers) who supported them in PEHR. Ultimately, these children showed improvement in their social and communication behaviors with

people. In the PEHR program, especially when the horse was trotting, PDD children started smiling and facially expressed their joy and pleasure. Then, they became eager to express their joyful feeling physically or verbally by babbling and, in the advanced stage, with meaningful words. They also became very willing to convey their happiness to their parents and looked for positive emotional responses in their parents' facial expressions through eye-to-eye contact.

The behavioral changes of PDD children observed in this study strongly support the hypothesis of "positive field of emotion" presented by Funahashi (1985). To further maintain the improved social and communication behaviors of the PDD children under normal social situations, including activities with family members at home, it is suggested that the positive and pleasurable field of emotion must be firmly formed and maintained. The PEHR program is clearly one way to stimulate a positive and pleasurable field of emotion in the minds of PDD children.

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# 心理教育学的乗馬療法による広汎性発達障害児の社会的対人行動の促進

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**要約**：われわれはすでに，広汎性発達障害児（PDD 児）に乗馬療法を実施すると，言語性・非言語性のコミュニケーションスキルの促進や両親に対する PDD 児らの感情表出がより快感情にあふれ豊かになることを示してきた。ただ，これらの効果が乗馬中だけではなく乗馬療法が済んだあとの日常生活状況でも維持されるかどうかが不明であったので，この点について，両親に対する質問紙調査を実施して検討した。その結果，いくつかの問題行動およびコミュニケーション能力において，心理教育的乗馬（PEHR）プログラムを体験した PDD 児と体験しない PDD 児の 2 群の比較で，統計的な有意差が認められた。例えば，PEHR 体験児は，非 PEHR 体験児に比較して，情緒的により安定し，より辛抱強く，パニックを起こしにくく，友人とより，うまくやれた。また，「ごっこ」遊びがよりスムーズにでき，両親の言語的な働きかけにより反応し，自分の意思や欲求をよりよく表現でき，両親の言語的指示をよりよく理解できた。これらの結果から，PEHR プログラムの効果は乗馬療法が終了したあとの日常生活の場面でもある程度，効果が維持されることが示唆され，この現象の理論的な説明として快情動場の概念とその維持の重要性が指摘された。

キーワード：広汎性発達障害児，コミュニケーション，動物介在教育・療法，乗馬療法，快情動場

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