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RESPONSE OF FUNCTIONAL PERFORMANCE TO HIPPOTHERAPY PROGRAM IN PEDIATRIC WITH SPASTIC CEREBRAL PALSY

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***Abstract*— Objectives: The aim of this study was to investigate the response of functional performance to Hippotherapy program in children with spastic cerebral palsy.**
Methods: Twenty six children with spastic cerebral palsy (17 boys and 9 girls) participated in this study. Their age ranged from 5-10 years and their BMI less than 25. The twenty six children were assigned to two groups; (A) and (B) each group consisted of 13 children. Group A received Hippotherapy program (HT) in addition to traditional physical therapy program and group B received same traditional physical therapy program without any additional program. The pediatric evaluation of disability scale (PEDI) was measured before and after the 10-week intervention.
Results: There were no significant differences in any baseline characteristics of the two groups before the intervention ($p>0.05$). While, post treatment comparison indicated significant differences of all parameter measures in favor of the HT group ($p<0.05$) when compared with the control group.
Conclusion: Ten weeks of Hippotherapy program have positive effects on functional performance in children with spastic cerebral palsy.

***Index Terms* — Pediatric, Cerebral Palsy, Hippotherapy, Functional Performance, PEDI Score.**

I. INTRODUCTION

Cerebral palsy (CP) is identified as a group of permanent motor dysfunctions related to a non-progressive lesion that presents in the immature brain [1].
The CP children have various degrees of movement disorders and posture, which can restrict physical activity and daily life activities [2].
Two types of horseback riding therapy are widely available: Hippotherapy and therapeutic horseback riding (THR). In Hippotherapy, a physical or occupational therapist controls the horse to influence the child's posture, balance, coordination, strength and sensorimotor systems, while the child interacts with the horse and responds to the movement of the horse [3,4]. On the other hand, THR is led by a trained riding instructor with the child actively controlling the horse as a form of exercise to improve coordination, balance and posture, and to encourage development of sensory and perceptual motor skills [5,6].
Hippotherapy (HT) is a physical therapy treatment strategy in which the movement of a horse is used to improve posture, balance, and overall function. Its inclusion as part of a comprehensive treatment plan to enhance physical therapy outcomes has the added benefit of engaging and motivating the child. HT has been used for decades in the treatment of children with cerebral palsy, as well as for such conditions as multiple sclerosis, traumatic brain injury, developmental delay, muscular dystrophy, and sensory impairments [7].
In spite of some differences between HT and therapeutic riding (THR), their therapeutic goals are essentially the same for children with CP. The warmth and shape of the horse and the rhythmic, three-dimensional movement of horseback riding are believed to improve the flexibility, posture, balance and mobility of the rider. The potential for horseback riding therapy to promote gross motor function in children with CP has been investigated previously with mixed results. Some reports demonstrated the benefits of horseback riding therapy on reducing abnormal tone, promoting motor performance, creating symmetric alignment and improving postural awareness, gait and mobility [8,9]. Many studies approved that there is no significant effects of horseback riding therapy [10-12].
In previous meta-analysis, it was approved that there was insufficient evidence to support the benefits of horseback riding therapy on gross motor function [13].
Although this poor evidence on the positive effects of HT, It is still recommended by physiotherapists for CP children for enhancing gross motor function. More studies are required to evaluate the benefits of Hippotherapy in CP children.

II. OBJECTIVES

The aim of this study was to investigate the response of functional performance to Hippotherapy program in children with spastic CP.

A. Subjects, Instrumentation and Procedure

1) Subjects

Twenty six cerebral palsied children (17 boys and 9 girls) participated in this study. They were diagnosed as spastic hemiparetic cerebral palsy children. Their age ranged from 5 to 10 years and body mass index less than 25. They were able to follow simple verbal commands and instructions during both evaluation and treatment, able to stand unassisted and ambulate with abnormal gait pattern, had no visual, auditory or perceptual deficits, and had neither structural deformities nor surgical operations in the affected lower limb. Children with a history of epilepsy, dorsal rhizotomy, severe intellectual disability, and previous HT was excluded from this study. Children were classified randomly into two groups of equal number, as the HT group (A) which included 13 children (9 boys, 4 girls) received the traditional physical therapy program

in addition to Hippotherapy and the control group (B) which included 13 children (8 boys, 5 girls) received only the same traditional physical therapy program which was given to a group (A) without any additional program for 10 successive weeks (3 sessions/week). Consent forms were obtained from children's parents before enrollment in the study. The study was conducted at the outpatient physical therapy clinic, Pediatric University Hospitals, Cairo University.

2) Evaluation

All children were obtained for assessment before starting the program as the following [14]:

The Pediatric Evaluation of Disability Inventory score (PEDI) and gross motor function measure were recorded as they are particularly applied in CP pediatric and proper reliability and validity criteria with regard to changes.

Pediatric evaluation of disability score evaluates functional abilities of the child at the international classification of function activity level and performance in functional activities of daily life.

3) Measurements

The Pediatric Evaluation of Disability Inventory score (PEDI) is an international measure, used to investigate ability and performance of child in daily life. This ability determines what a child can do, while functional performance determines what a child actually does in their environment [15]. Ability is measured by defining functional skills mastery in these three fields: self-care, mobility and social functioning. Function performance is measured according to parental reports of whether the child is able to perform each of 197 tasks in these fields in daily environments, like, home and school. In this study, Pediatric evaluation of disability scale was applied to measure what a child actually does in these fields. The Pediatric evaluation of disability scale was performed by pediatric physical therapists through arranged interviews with the child's parent. Each measure was recorded as either cable (score 1) or unable (score 0). The Pediatric evaluation of disability scale was recorded before and at the 10th week after intervention program.

4) Intervention

HT group (A) which included 13 children (9 boys, 4 girls) received the traditional physical therapy program in addition to Hippotherapy and the control group (B) which included 13 children (8 boys, 5 girls) received only the same traditional physical therapy program which was given to a group (A) without any additional program for 10 successive weeks (3 sessions/week).

The Hippotherapy (HT) intervention program; In a recent systematic review, each session was 45 min of THR or HT for 8-10 weeks was associated with beneficial effects on gross motor function in children with CP [4]. According to this recent review results, the current study provided 45 min one session weekly for 10 weeks for group (A) HT program.

HT program was performed by a pediatric physical therapist. The therapist walked along either side of the horse for child assistance. The therapist observed main objectives which aimed to develop the sensorimotor and perceptual-motor skills of the child. The child was seated astride the horse wearing protective head covering and was encouraged to perform different activities intended to stress movement in a forward and upward, reaching to support active postural control, trunk strength, balance and trunk-pelvic separation.

B. Statistical analysis

Descriptive statistics (mean and standard deviation) were computed for all outcome measures. Paired and unpaired t-tests were used to compare the mean differences of the study variables within and between both groups respectively. Level of significance was set at $p<0.05$ for all statistical tests. Statistical analysis was completed using SPSS, version 16.

III. RESULTS

As demonstrated in table 1, there were no significant differences in baseline characteristics between HT and control groups at the beginning of the study regarding their ages, weights, heights, gender, and their affected side ($p>0.05$).

Table 1: Baseline characteristics

Items		HT group (n=13)	Control group (n=13)	p-value
Age (yrs)		8.66 ± 0.67	8.21 ± 0.78	0.128[a]
Weight (kg)		41.42 ± 2.16	40.59 ± 1.89	0.307[a]
Height (cm)		140.17 ± 4.26	138.28 ± 5.03	0.311[a]
Gender, n (%)	**Boys**	9 (69.2)	8 (61.5)	0.578[b]
	Girls	4 (30.8)	5 (38.5)	
Affected Side, n (%)	**RT**	6 (46.2)	7 (53.8)	0.699[b]
	LT	7 (53.8)	6 (46.2)	

[a] p-value of independent t-test
[b] p-value of Mann-Whitney U test

Pediatric Evaluation of Disability Inventory score (PEDI); As demonstrated in table 2, Comparison of the pre-treatment mean values of PEDI score, self-care, mobility, and social functioning between both groups indicated non-significant differences ($p>0.05$). While, post treatment comparison indicated significant differences of all parameter measures in favor of the HT group ($p<0.05$) when compared with the control group.

Table 2: The between group differences of the pediatric evaluation of disability score (PEDI) before and after treatment.

Items	Pre-treatment			Post-treatment		
	HT group	Control group	p-value	HT group	Control group	p-value
PEDI score	114.14±26.23	113.41±33.61	0.951	139.32±14.45*	116.38±11.42	0.002*
Self-care	39.98±9.66	41.11±8.54	0.755	47.19±4.14*	43.21±5.21	0.041*
Mobility	30.11±11.05	29.93±12.27	0.969	35.32±3.51*	31.23±5.43	0.032*
Social functioning	44.65±13.14	44.23±16.33	0.943	48.72±4.34*	45.08±3.67	0.029*

Values are mean ± standard deviation
*significant at p<0.05

IV. DISCUSSION

The pediatric evaluation of disability inventory scale (PEDI) has been commonly applied to investigate the functional performance of children with CP [14,16]. The PEDI score was provided for children up to 7.5 years of age, but this can be extended to children with functional disabilities [17].

In the current study, the PEDI was applied to measure the functional performance in daily life of children older than 7.5 years. In previous literature review, the PEDI score was applied as a measurement in only one study by Casady and Nichols-Larsen [8]. In that study, they provided significant improvement in the total PEDI score as well as its 3 fields of self-care, mobility and social functioning. But, the sample size was very small (n=10), no control group and the large variability in the frequency of physical, occupational and speech therapy which limits the applicability of these results.

The current study reported significant improvements in all 3 PEDI fields of self-care, mobility and social functioning in the Hippotherapy group, but not in the control group. These findings suggest some positive effects of HT on the child's actual performance in daily life. The mobility field is solely related to gross motor function based on GMFCS level, [18] while the self-care field is related to both GMFCS level and hand function based on manual ability classification system score [19]. According to a previous study, HT improved dynamic trunk stability and functional reach in children with spastic diaplegia [9]. These positive effects of Hippotherapy occur likely to contribute the significant response of self-care and mobility domains in the current study.

The third field (social functioning field) is affected by different factors such as education, socioeconomic status, cognition, communication abilities and motor function [18]. The favorable time to apply or practice communication, listening and language skills during Hippotherapy may have led to the improvements observed in PEDI social functioning, in line with Casady and Nichols-Larsen's report [8].

In contrast, actual performance in daily life is affected by the physical environment, personal and social factors [15,20]. The significant PEDI response suggests that Hippotherapy stimulate the child's encouragement and willingness for enrolling in an activity [8].

Despite of functional level may affect the gross motor outcome after Hippotherapy, the sample size of the current study was insufficient to group children according to gross motor function level. This deposition would be important to select children who would benefit most from this type of intervention.

Although there was no significant difference in mean age between groups, nor in the ratio of younger to older children between groups, the proportion of children aged from 5 to 10 years was slightly higher in the Hippotherapy group, which may have biased the results. Age likely affects gross motor improvements, as young children may have greater potential for improvement. Further study is needed to examine the effect of age on the positive effects of Hippotherapy program.

In brief, Hippotherapy has become a popular modality for children with CP that is believed to stimulate gross motor function; the relatively greater improvements in PEDI scores observed suggest that Hippotherapy helps children to engage more meaningfully in the functional activities of daily life. Further studies to determine who would benefit most from Hippotherapy would be useful to expand the use of Hippotherapy as a therapeutic intervention to maximize functional performance in children with spastic CP.

CONCLUSION

Ten weeks of Hippotherapy program have positive effects on functional performance in children with spastic cerebral palsy.

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Declaration of interest

No conflicts of interest.

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