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Hippotherapy As an Effective Treatment Strategy for Paediatric Population with Disabilities: A Literature Review

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ABSTRACT

Background: Hippotherapy is an equine-assisted therapeutic method for the development of physical, occupational, and emotional performance in people suffering from various maladies. The neurophysiology of hippotherapy is characterized by the cyclical rhythmic movement of the horses, which is a kind of sensory input providing the rider with the information needed to maintain the proprioceptive and vestibular systems. It is the act of falling and jumping process that encourages neural pathways responsible for the development of the motor system which gradually results in the development of balance and coordination. To wit, the motion of those animals is one such that they imitate the normal human body's walking pattern and in effect, like physiotherapy, they provide familiarity and thereby help in reskilling the rider's core muscles and postural alignment. Furthermore, the relationship between the horse and the human being can also contribute to the emotional and spiritual side of the human being, thus, resulting in a more holistic approach to therapy that could be shown in practice through such modes as horse therapy.

Methodology: We performed literature searching multiple electronic databases. The searches generated 50 potentially relevant studies. After applying inclusion and exclusion criteria, eliminating repeated articles, and critically evaluating the obtained results, nine papers were selected for the analysis. The selected papers were published between the period of January 2019 to July 2024. This comprised two cross-sectional studies, one experimental study, one exploratory study, one randomized controlled trial, and one survey investigation.

Results: This literature review noticed a connection between hippotherapy and observable improvements in balance, coordination, gait, motor functions, cognitive functions, flexibility, functional mobility in children with disabilities.

Conclusion: Hippotherapy has benefited balance, coordination, gait, motor functions, cognitive functions, flexibility, and functional mobility in children with disabilities, and thus, it should be considered as a treatment strategy for treating children with disabilities.

Keywords: Hippotherapy, Therapeutic Horseback Riding, Children, Treatment, Paediatric Condition, Balance, Trunk Control, Motor Functions, Cognitive Functions.

INTRODUCTION:

The pediatric population is commonly affected by conditions that effects their improved development of

motor skills, abnormal gait patterns, trunk control, pelvic stability, balance problem, and poor coordination which have an adverse effect on their developmental milestones. Delayed development of motor skills, abnormal gait patterns, balance problems, muscle weakness, and poor coordination are prevalent symptoms across various pediatric conditions that require physiotherapeutic intervention. Motor skill delays can be associated with neuro developmental disorders such as cerebral palsy, or genetic conditions like Down syndrome. Abnormal gait patterns often result from musculoskeletal issues such as congenital abnormalities, orthopedic injuries, or neurological impairments affecting posture and movement control. Balance problems are commonly observed in children with conditions like vestibular disorders or sensory processing difficulties. Early identification and intervention play crucial roles in improving outcomes and quality of life for pediatric patients facing these challenges.[1,2]

Hippotherapy is a form of treatment that uses horseback riding as part of physical, occupational, or speech therapy sessions. It is derived from the Greek word "hippos," meaning horse. Having started in Europe in the 1960s, it was then becoming well-known because of its therapeutic value. Liz Hartel, a Danish equestrian who overcame her bout with polio to compete in the 1952 Olympics, is often credited as a modern-day pioneer in hippotherapy. She was inspired by its therapeutic value by her own riding experiences for therapy. In Europe, hippotherapy was also being developed by a physician, Dr. Théodore Dimancescu, of the Cozia Hospital in Romania, who became impressed by the improvement seen in his patients sent to such therapy due to physical and neurological impairments.[1,3]Mechanism of hippotherapy mainly works on three-dimensional movement along with sensory stimulation and core strengthening. Three-Dimensional Movement: The horse's gait creates rhythmic motions that simulate the gait cycle in human beings. These are multi-dimensional patterns resulting in side-to-side, forward-backward, and up-down motions. The variability and the degree of complexity of movement challenge balance, coordination, and posture control for the rider on the horse.[1]Sensory Stimulation: The horse's movement provides the rider with vestibular, proprioceptive, and tactile input. This sensory stimulation cultivates enhanced sensory integration and motor planning.[1]Core Strengthening: Balancing on a moving horse requires the rider to work their core to maintain balance and stability. Repeated exercises have the effect of strengthening the core muscles over time, which will contribute to good posture and functional movement.[1]

The stabilometric analysis demonstrated that the center of the pressure region was lower in the closed-eye condition. Moreover, the recordings of the center of pressure sway were reduced in open and closed-eye conditions. Furthermore, the patients with Down syndrome had decreased medio-lateral and anteroposterior velocity oscillations when their eyes were closed. Finally, hippotherapy led to considerable improvements in step length and velocity.[2] A study involving nineteen children with autism spectrum disorder under the age category of seven-fifteen years underwent hippotherapy treatment for five months with 35 therapeutic sessions per week for 15-20 minutes. The outcome demonstrated an improvement in body equilibrium resistance, correct body position, torso straightening, and head position.[3] A group of thirty children was randomly allotted to 1 of the 3 treatment groups namely: Blanket Hippotherapy Group, Control Group, and Saddle Hippotherapy Group. The study showed that the hippotherapy enhanced the neuromuscular activation of trunk and back muscles following the 30 minutes' session.[4] According to other research conducted on 123 Israeli children diagnosed with ADHD concluded that therapeutic horseback riding (THR) improved the executive functions and self-esteem in those kids who underwent twenty weeks of therapeutic sessions.[5] Another study was done on forty school children having moderate to severe mental disabilities between the age of fourteen to twenty

years split up into 2 groups each of which included twenty members. According to this research, hippotherapy treatment enhanced equilibrium, coordination, and flexibility in individuals with moderate to severe mental impairments.[6]

A study conducted on young children with developmental delay resulted in enhanced gross motor ability. Functional motor abilities improved dramatically along with the mean percent motor delay score dropped by 24.1 points from the pre-test to the post-test, demonstrating a substantial decrease in delay following hippotherapy.[7] In a study by Tuğrulhan et al., twenty-four children with cerebral palsy, down syndrome, and intellectual disability were split into three groups and given fifteen sessions of hippotherapy. The functional balance of children with specific sensory deficits was improved by hippotherapy.[8] Another study was conducted on fifteen children who underwent a one-year hippotherapy programme on the mental functioning and physical ability of children having cerebral palsy. Systemic hippotherapy sessions improve physical fitness and daily functioning in children who have Cerebral Palsy.[9] According to the current research which included 34 children who have Down syndrome are split up into 2 groups that underwent hippotherapy sessions along with regular physiotherapy sessions had functional independence, functional mobility, and a significant improvement in balance in kids who have Down syndrome.[10]

NEED OF THE STUDY:

The above-mentioned articles showed that the clinical application of hippotherapy has shown a significant improvement in the children diagnosed with the different paediatric conditions. Including hippotherapy in the treatment strategy has significantly improved the development of motor skills, abnormal gait patterns, trunk control, pelvic stability, balance problem, and poor coordination. Children tend to get distracted and less attentive towards the daily physical exercises and activities so including an equine assisted therapy like hippotherapy can increase their attention and concentration on the sessions as children are curious and affectionate towards the animal.

AIM OF THE STUDY:

This review aims to conclude the benefits of hippotherapy as an effective treatment strategy for various paediatric conditions.

METHODOLOGY:

A literature search was performed using multiple electronic databases such as Science Direct, PubMed, Cross Ref, Scopus, JSTOR, and Google Scholar and the following keywords were used: “hippotherapy”, “therapeutic horseback riding”, “children”, “treatment”, “paediatric condition”, “balance”, “trunk control”, “motor functions”, “cognitive functions”. The articles selected were published between the period of 2019 to July 2024. Our searches generated 50 potentially relevant studies. After applying inclusion and exclusion criteria, eliminating repeated articles and critically evaluating the obtained results, nine articles were selected for the review.

INCLUSION CRITERIA:

- Age between 2-20 years
- Both male and female gender
- Children and adolescents showing issues with balance, gait patterns, coordination, trunk control, mo-

tor functions, and cognitive functions.

EXCLUSION CRITERIA:

- Children having allergies to horse hair, hay, dust
- Children having previous horse riding/ therapy experience
- Any systemic conditions or congenital cardiac problems
- Children suffering from uncontrolled seizures, recent surgery or birth defects
- Atlo-occipital instability[1]
- Children having congenital scoliosis and scoliosis above 30° [6,7]
- Hip dislocation[7]
- Behaviour problems (inability to follow instructions/directions)
- Children that had Botulinum Toxin applied to them within six months before the research[7]
- Exclusions indicated by the PATH Intl. Standards[6]
- Systematic reviews /cloned articles

REVIEW OF LITERATURE:

1. **CAN INDIVIDUALS WITH DOWN SYNDROME BENEFIT FROM HIPPOTHERAPY? AN EXPLORATORY STUDY ON GAIT AND BALANCE** by *Simona Portaro et. al,2019, Developmental Neurorehabilitation*

This study investigates the potential effects of hippotherapy routines on children with Down syndrome's gait and balance. Fifteen patients were male who completed a six-month hippotherapy treatment. Assessments of gait, baropodometry, and stabilometry were done at the start and finish of the treatment. It was observed that Down Syndrome patients, at the beginning, had a reduced pressure percentage of bilateral hind foot on baropodometric analysis; an increased centre of pressure area in the condition of closed-eye with a high centre of pressure sway in open and closed-eye recordings, followed with an increased medio-lateral and antero-posterior velocity oscillations in the closed-eye condition; and a decreased step-length as well as velocity. Upon completion of six months of hippotherapy, down syndrome people showed a significantly greater proportion of bilateral hind foot pressure. Stabilometric analysis showed an area of the centre of pressure reduced in the condition eyes were closed and the centre of pressure sway was reduced in both open and closed recordings. Furthermore, down syndrome patients had decreased mediolateral and anteroposterior velocity oscillations when their eyes were closed. Finally, hippotherapy led to considerable improvements in step length and velocity. However, patients with Down syndrome who received hippotherapy treatment had functional gains in bilateral symmetry, balance, and gait speed width.

2. **EFFECTS OF HIPPOTHERAPY ON MOTOR ASPECTS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS** by *Diyana Georgieva et.al,2020, Research in Kinesiology.*

This study assessed how riding horses affected the motor skills of kids with autism spectrum disorders. Nineteen children aged seven to fifteen who had been diagnosed with autism spectrum disorders participated in this experimental investigation. Fifteen to twenty minutes treatment of sessions were conducted for five months during the investigation. Single-leg balance test and posture assessment Bertotti scale, which covered three stages of application (pre-therapy, intermediate stage, and post-therapy stage), were the two standardized tests that were used. The results were significant in revealing the impact of horseback riding on the children's body posture and equilibrium stability. The outcome

demonstrated an improvement in body equilibrium resistance, correct body position, torso straightening, and head position.

3. **NEUROMUSCULAR ACTIVATION ANALYSIS OF THE TRUNK MUSCLES DURING HIPPOTHERAPY SESSIONS** by *Júlio Ribeiro Bravo Gonçalves Junioret.al,2020*

The objective of this research had been to examine the behavior of neuromuscular activation for four time periods of the Upper Trapezius muscles, Multifidus, Longissimus, and Iliocostalis of children during a functional task performed in hippotherapy sessions. Thirty children in total were divided into three groups at random: the Blanket Hippotherapy Group, the Saddle Hippotherapy Group, and the Control Group. An electromyography was used to record data while performing a functional job It included shifting the trunk to retrieve something. Four assessments were done during the course of the session. After a half-hour workout, the Multifidus muscles, Iliocostalis, and Longissimus showed a considerable rise in activation of neuromuscular. Within 10 minutes, there was enhanced neuromuscular activation in the Trapezius muscle. After twenty and thirty minutes, it kept rising. Hippotherapy treatment thereby improved neuromuscular activation.

4. **THE CONTRIBUTION OF THERAPEUTIC HORSEBACK RIDING TO THE IMPROVEMENT OF EXECUTIVE FUNCTIONS AND SELF ESTEEM AMONG CHILDREN WITH ADHD** *by Tal-Li Matild Aviv et.al, 2020, Journal of attention disorders*

The purpose of this study is to look into the possible advantages of THR on 123 Israeli youngsters with ADHD diagnoses' executive functioning and self-esteem. While the control group simply received medications, the research group also received THR sessions for 20 weeks. Questionnaires were completed by the mothers and their children before, during, and twelve weeks following the conclusion of the treatment. The executive functions of the children and self-esteem were examined using some latent growth models. The outcomes demonstrated that executive functions and self-esteem were enhanced by THR. Therefore, THR is a useful therapeutic approach to raise children with ADHD's executive functions and self-esteem.

5. **EFFECTS OF HIPPOTHERAPY ON BALANCE AND COORDINATION IN MENTALLY DISABLED CHILDREN** *by Sam Cemil Tuğrulhan et.al, 2021*

This study focuses on the benefits of hippotherapy training on children with moderate to severe mental disorders in terms of balance and coordination. This study included forty students with moderate to severe mental disorders aged fourteen to twenty years who were enrolled at Erzurum's special education practice school. Individuals were separated into 2 groups: Hippotherapy Group-HG & Control Group-CG (twenty persons in each group). To initiate the intervention, participants' height and age were noted, and their weights had been determined using a Digital scale. Balance skills were pre-tested by using the Flamingo balancing test, the balance board test, the touch test for coordination, the sit-and-reach test, Illinois agility test, and the T-agility test for flexibility. Following the pre-tests, twenty participants in the HG group underwent 20-minute hippotherapy instructions twice a week for 8weeks. The control group did not get any type of training. Final assessments were administered a week after the hippotherapy course was completed. The body composition of the patients in the HG groups did not alter much, although there were improvements in balance, coordination, and flexibility after eight weeks of hippotherapy sessions. There were not much differences in the subjects of the CG group. This study found that hippotherapy improved balance, coordination, and flexibility in those with moderate to severe mental disabilities.

6. **GROSS MOTOR SKILLS AND GAIT PERFORMANCE IN TWO AND THREE YEAR OLD CHILDREN WITH DEVELOPMENTAL DELAY PARTICIPATING IN HIPPOTHERAPY** *by Heidi A Brady et.al, 2021, Journal of equine veterinary science*

This study demonstrated the impact of fifteen hippotherapy sessions (HPOT) on the gross motor performance in two-three years old children with gross motor developmental delay, n=11 as compared to typically developing age-matched controls, n=6. Both groups' gross motor abilities were assessed using the Battelle Developmental Inventory, Second Edition, and gait parameters were analyzed using a computerized gait analysis system both before and after the study. The developmental delay group participated in fifteen HPOT sessions, but the CON group did not engage in any horse activities. Following the HPOT session, functional motor abilities improved significantly. The mean percent motor delay score in the developmental delay group dropped by 24.1 points between the prior test and the follow-up test, demonstrating a significant reduction in delay following HPOT sessions. However, the 2nd edition motor scores of the mean Battelle developmental inventory of the CON group were the same from prior test to follow-up testing. The scores of the two groups differed considerably, indicating that the developmental delay HPOT group achieved better scores compared to the control group. The gait performance assessments of the developmental delay group did not yield significant differences between the pretest and post-test following HPOT; however, step length and step width exhibited improvement tendencies. The outcome showed that hippotherapy sessions in children having developmental delays can enhance gross motor ability.

7. **ASSESSMENT OF FUNCTIONAL BALANCE IN CHILDREN WITH SENSORY IMPAIRMENTS UNDERGOING HIPPOTHERAPY** *by Janaine Brandão Lage et.al, 2021*

The purpose of this investigation was to measure functional balance in sensory-impaired children undergoing hippotherapy. A study including 24 kids with intellectual disability, down syndrome, and cerebral palsy, was separated into three age groups: group 1 (10.71±2.69 years), group 2 (12.83±2.64 years), and group 3 (11±1.69 years). The fifteen hippotherapy attendees, each with their riding equipment. The Paediatric Balance Scale (EEP) evaluated functional balance for fifteen pre and post-sessions. After attendance, the EEP scores increased for all 3 groups (intra-groups), but with a significant increase for children with intellectual disability and Down syndrome, while the cerebral palsy group had lower scores (inter-groups) both before and after attendance. Hippotherapy improves the functional balance.

8. **HIPPOTHERAPY IN CEREBRAL PALSY-SURVEY RESEARCH** *by Włodzisław Kuliński, 2023, National Library of Medicine.*

The objective of this research is to assess the effects of a one-year hippotherapy rehabilitation program on the cognitive and motor abilities of children diagnosed having Cerebral Palsy. The mean age of the fifteen cerebral palsy youngsters involved in this study was nine years old. For a year, the kids went to hippotherapy sessions at the Rusinowice rehabilitation facility. The central nervous system injury-induced motor and postural impairments characterize the clinical presentation. Data on challenges related to day-to-day functioning and daily life were gathered by a survey questionnaire. According to the findings, eight out of fifteen children had spastic cerebral palsy, which was the most frequent type of condition. Respondents from mixed cerebral palsy 40%, 67% knew about hippotherapy already, and 33% were unaware of it. Systemic hippotherapy sessions improve physical health and day-to-day activities in children who have cerebral palsy.

9. EFFECT OF HIPPOTHERAPY ON BALANCE, FUNCTIONAL MOBILITY AND FUNCTIONAL INDEPENDENCE IN CHILDREN WITH DOWN SYNDROME *by Yelda Kaya et.al, 2023, European Journal of Pediatrics*

The intention of conducting this research was to check the effectiveness of hippotherapy affecting balance, functional independence, and functional mobility in children who have Down syndrome. Following the initial examination, 34 children with Down syndrome were randomly split up into an Experimental Group, identified as hippotherapy, and a Control Group. Both groups received physiotherapy, which included exercises for maintaining balance; however, the Experimental Group received hippotherapy as an integrated therapy. Both before and after the intervention, the Pediatric Balance Scale (PBS), Timed-Up and Go Test (TUG), and Functional Independence Measure for Children (WeeFIM) were given out. Both groups showed improved PBS and TUG scores after the intervention, whereas, the improvement in scores of WeeFIM occurred only in the hippotherapy group.

RESULTS:

According to the Pediatric Balance scale, functional balance scores among the pre and post-care times of all groups observed to be greater during post-care. Higher values were noted during horseback riding in the Bertotti test for posture assessment. This helped children develop their head control and straighten their torso during horseback riding. The subject's motor functions and cognitive functions seemed to improve with hippotherapy. The subjects in the hippotherapy group's gait performance did not substantially alter from pre-test to post-test. On the other hand, a trend toward narrower steps and faster gaits was seen, suggesting a more developed gait pattern. Hippotherapy was also found to improve a higher percentage of hind foot pressure for both limbs and step length but did not show much effect on step velocity. The subject's body composition did not alter significantly in the hippotherapy group, but they did improve their balance, coordination, and flexibility.

DISCUSSION:

The main purpose of this review of the literature was to determine whether hippotherapy treatment helps improve children with balance, coordination, gait, trunk control, motor functions, and cognitive function disabilities in various pediatric conditions.

According to the nine selected articles, hippotherapy has beneficial effects on children with various pediatric conditions (Down Syndrome, Autism Spectrum Disorders, Mentally Disabled, Developmental Delay, Cerebral Palsy, and Sensory Impairments). The articles comprised comparison groups to verify the effects of hippotherapy on children. It has been determined that hippotherapy performed a positive function on the effects of static and dynamic balance levels of certain subjects. It is important to develop balance, coordination, trunk control, and gait in disabled children to prevent falls and avoid physical and psychological negative impacts on them. Simona Portaro et.al, Sam Cemil Tuğrulhan et.al, Janaine Brandão Lage et.al and Yelda Kaya et.al found that balance was improved after the use of hippotherapy. Heidi A Brady et.al and Simona Portaro et.al observed that there was an improvement in the gait pattern which helped the children walk better by improving the step width, step length and velocity, speed width, and bilateral symmetry.

Diyana Georgieva et.al concluded that body equilibrium resistance, correct body position, torso straightening, and head position were improved which eventually developed trunk control in those children. Trunk control is necessary for children to improve their posture stability and functional

balance. According to survey research conducted by Włodzisław Kuliński, systemic hippotherapy sessions improved physical fitness and daily functioning in subjects with Cerebral Palsy. Gross focused on the behavior of neuromuscular activation of trunk muscles such as iliocostalis, longissimus, multifidus, and trapezius muscles through functional tasks which helped in trunk control. The author Tal Li Matild stated an improvement in executive functions and self-esteem in his study. A significant improvement was seen in coordination and flexibility in children in a study by Sam Cemil Tuğrulhan et.al. Functional mobility and functional independence were seen to be enhanced in a study by Yelda Kaya.

CONCLUSION:

This review of the literature concludes that hippotherapy as a treatment strategy has positive effects on the functional aspects of children affected with paediatric conditions. Balance, coordination, gait, motor functions, cognitive functions, flexibility skills, and functional mobility were seen to benefit from hippotherapy. Hence, hippotherapy can be used as a treatment strategy for children suffering from paediatric conditions like Down Syndrome, Autism Spectrum Disorders, Mentally Disabled, Developmental Delay, Sensory Impairments, and Cerebral Palsy. Hippotherapy will help improve the quality of life in kids who have disabilities.

LIMITATIONS AND FUTURE RECOMMENDATIONS

Due to limited studies available with these parameters about hippotherapy, we were not able to get considerable information, hence there is a prerequisite for more studies to be done on hippotherapy and confounding parameters.

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