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## **The Impact of Hippotherapy on Motor Function in Children with Cerebral Palsy**

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**ABSTRACT**

**Background.** Cerebral palsy (CP) is a group of disorders resulting from permanent damage to the central nervous system, typically occurring during the prenatal, perinatal, or early postnatal period. It is one of the leading causes of physical disability in children and is commonly associated with impaired motor development, muscle tone abnormalities, and postural control deficits. In addition to conventional physiotherapy, alternative therapeutic approaches are increasingly being incorporated into rehabilitation programs. One such method is hippotherapy – a form of movement-based therapy utilizing the three-dimensional motion of a horse to stimulate neuromotor functions.

**Aim.** The aim of this review is to analyze current research findings on the impact of hippotherapy on motor function development in children with cerebral palsy and to assess its therapeutic value.

**Material and methods.** This paper presents a literature review based on scientific articles selected from databases such as PubMed and Google Scholar, focusing on studies that examined motor outcomes in children with CP undergoing hippotherapy.

**Results.** The literature confirms that hippotherapy can lead to significant improvements in balance, coordination, postural stability, and general motor functions in children with cerebral palsy. It is also well tolerated by patients and increases their motivation for further therapy.

**Conclusions.** Hippotherapy is an effective adjunctive intervention in the rehabilitation of children with cerebral palsy. Its incorporation into therapeutic programs may enhance motor outcomes and improve the overall quality of life. Further research is recommended to refine protocols and confirm long-term benefits.

**Keywords:** hippotherapy, children, motor functions, cerebral palsy, rehabilitation, equine-assisted therapy

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## 1. Introduction

### 1.1 Introduction to the issue of cerebral palsy (CP) and motor disorders

Cerebral palsy (CP) is a group of symptoms caused by permanent damage to the central nervous system, occurring during the prenatal, perinatal, or early postnatal period. Such damage leads to motor development disorders, abnormalities in muscle tone, and difficulties in maintaining proper posture<sup>1</sup>.

The complex symptomatology of CP may also include sensory, perceptual, and cognitive dysfunctions, as well as secondary orthopedic deformities and coexisting epileptic seizures. These factors significantly limit a child's daily activity and negatively impact overall psychosocial functioning<sup>2</sup>.

The clinical picture of cerebral palsy varies depending on the location and extent of brain damage. Four primary types of CP are distinguished: spastic (pyramidal), athetoid (extrapyramidal), ataxic (cerebellar), and mixed. This classification is based on the affected areas of the central nervous system and the scope of motor dysfunction and limb mobility deficits<sup>3</sup>.

In the European population, cerebral palsy is one of the most common causes of physical disability in children, with an estimated prevalence of 2–3 cases per 1,000 live births.

Due to the complex nature of the condition, treatment and rehabilitation should be comprehensive and interdisciplinary. Planned medical interventions, pharmacological treatment, and therapeutic activities aimed at supporting motor development should be well-coordinated, continuous, and individualized, taking into account each patient's unique needs<sup>4</sup>.

## **1.2 Overview of hippotherapy as a form of rehabilitation**

Rehabilitation is a key component of comprehensive care for patients with cerebral palsy. Although the symptoms are permanent, properly conducted motor therapy can support the development of compensatory movement mechanisms and contribute to improving the quality of life<sup>5</sup>.

In the long-term perspective, the primary goals of rehabilitation include enhancing quality of life, striving for the highest possible level of independence, and promoting motor skills development that enables participation in everyday activities.

Due to the complex clinical picture of children with cerebral palsy, the rehabilitation process requires a long-term, multidisciplinary approach involving various therapeutic methods.

In clinical practice, standard rehabilitation techniques are most commonly used, including conventional physiotherapy (e.g., the NDT-Bobath concept), occupational therapy, manual techniques, and functional exercises<sup>6</sup>.

Modern therapeutic solutions such as robotic-assisted therapy, biofeedback systems, and balance training platforms are also gaining wider application<sup>7</sup>.

Within a supportive framework, the importance of alternative therapies is growing as well.

One such complementary motor therapy method is hippotherapy, which utilizes the movement of a horse to improve physical function. The horse's three-dimensional movement closely resembles the natural gait pattern of a human, which allows hippotherapy to positively stimulate the child's neuromuscular system<sup>8</sup>.

In addition to motor benefits, hippotherapy has a motivating effect on young patients, increasing their engagement in therapy and being one of the most well-accepted forms of rehabilitation among children.

## **1.3 The importance of reviewing current research**

The analysis and review of studies examining the impact of hippotherapy on motor abilities in children with cerebral palsy help to organize and consolidate the existing body of knowledge in this field<sup>9</sup>.

An analytical approach supports the development of optimal therapeutic plans tailored to the needs of patients with this condition<sup>10</sup>.

A synthesized evaluation of available research findings not only indicates directions for further development of this form of rehabilitation, but also serves as a practical guide in clinical decision-making<sup>11</sup>.

## 1.4 Aim of the Study

The aim of this review paper is to evaluate the impact of hippotherapy on the development of motor skills in children with cerebral palsy (CP) based on available scientific research. The study seeks to organize and synthesize dispersed knowledge in this area and to indicate the extent to which hippotherapy can serve as an effective complement to conventional rehabilitation methods.

## 1.5 Methodology of the Literature Review

The literature review on the impact of hippotherapy on the development of motor skills in children with cerebral palsy was conducted in a systematic manner, using predefined selection criteria.

The search for relevant publications was carried out in two well-established databases: **PubMed** and **Google Scholar**, both of which are recognized as reliable sources of scientific research in the fields of medicine and therapy.

The analysis included articles published between **2014 and 2025**, with a focus on the most recent and up-to-date studies.

The literature search was performed using a combination of the following keywords: *hippotherapy*, *cerebral palsy*, *motor skills*, *gross motor function*, *children*, along with the logical operators **AND** and **OR** to ensure precise results.

Publications were included in the review if they met the following criteria:

- published in peer-reviewed scientific journals,
- focused on children with cerebral palsy aged **3 to 12 years**,
- written in English,
- containing assessment of motor functions,
- available in full-text format.

The exclusion criteria were as follows:

- case studies describing single patients,
- studies conducted on adults or animals,
- non-peer-reviewed publications,
- articles duplicating findings from earlier research.

The final selection of materials was based on a full-text analysis for compliance with the established inclusion criteria.

## 2. Review of the Current State of Knowledge

### 2.1 Effectiveness of Hippotherapy in Improving Gross Motor Skills

Gross motor skills involve large-scale movements that engage major muscle groups and enable activities such as walking, running, jumping, maintaining balance, changing body positions, or handling large objects. The development of gross motor skills is closely linked to the maturation

of the child's nervous and muscular systems, and impairments in this area are typical in children with cerebral palsy (CP).

In CP, difficulties with postural control, motor coordination, and muscle tone significantly limit the independence of affected individuals. Therefore, improving gross motor function should be one of the primary goals of rehabilitation.

Hippotherapy, through the dynamic, three-dimensional, and rhythmic movement of the horse, can effectively support these rehabilitation goals by engaging various muscle groups, including postural muscles.

Scientific studies consistently indicate that hippotherapy positively influences gross motor function in children with CP. In a randomized controlled trial conducted by Kwon et al. (2015), 92 children aged 4–10 participated in an eight-week hippotherapy program. The results showed significant improvements in the GMFM-88 scale, particularly in balance and postural control<sup>12</sup>. Similar results were reported by Park et al. (2014), who observed marked improvements in motor functioning and daily living activities, assessed using the PEDI-FSS, in children with CP after eight weeks of hippotherapy. Their study involved 34 children aged 3 to 12 years, who participated in 45-minute sessions twice a week<sup>13</sup>.

In a meta-analysis conducted by Guindos-Sanchez et al. (2020), which included 10 studies with 452 participants, statistically significant effects of hippotherapy on gross motor function, as assessed by GMFM-66 and GMFM-88, were confirmed<sup>14</sup>.

Another systematic review by Ortega-Cruz et al. (2025), focusing both on conventional hippotherapy and horse-riding simulators, also confirmed significant improvements in gross motor function across nine studies, while noting the need for standardized protocols and larger samples<sup>15</sup>.

## **2.2 The Impact of Hippotherapy on Fine Motor Skills**

Fine motor skills involve precise movements, mainly performed using the hands and fingers, and require hand-eye coordination. These include activities such as grasping, writing, drawing, manipulating objects, and self-feeding.

In children with CP, fine motor skills are often significantly impaired due to spasticity, ataxia, and muscle weakness. Although hippotherapy does not directly target hand function, it can indirectly support the development of manual abilities by improving trunk stability, overall coordination, and muscle tone. Enhanced posture and head control may translate into better freedom and precision in upper limb movements.

Most studies focus on gross motor function, but some also highlight benefits in fine motor areas. Champagne et al. (2017) conducted a ten-week hippotherapy program with weekly 30-minute sessions. Assessments were performed twice before the intervention (T1 and T1'), immediately afterward (T2), and ten weeks post-intervention (T3). Motor function was evaluated using the GMFM-88 and the short form of the Bruininks-Oseretsky Test (BOT-2 SF). The results revealed statistically significant improvements in gross motor function and notable progress in three of the eight BOT-2 SF components: fine motor precision ( $p = 0.013$ ), balance ( $p = 0.025$ ), and muscular strength ( $p = 0.012$ )<sup>16</sup>.

## **2.3. Study Characteristics: Number of Participants, Duration, and Measurement Tools**

The reviewed studies varied in terms of participant numbers (ranging from 10 to 92 children), intervention duration (from 6 to 12 weeks), and measurement tools used.

In the scientific literature concerning the impact of hippotherapy on children with CP, standardized tools for assessing motor functions were commonly employed, including GMFM-88 and GMFM-66 (most frequently used), as well as PEDI-FSS and the Bruininks-Oseretsky Test (BOT-2). The GMFM scales primarily assessed gross motor skills, whereas the PEDI-FSS was used to evaluate a child's independence in daily activities. The BOT-2, which includes both fine and gross motor components, was applied in studies with a broader functional scope.

The use of these tools enabled objective and comparable evaluations of therapeutic progress and facilitated documentation of hippotherapy outcomes across different dimensions of motor development<sup>17, 18, 19</sup>.

## **2.4. Short-term and Long-term Effects**

### **Short-term Effects**

Studies have shown that hippotherapy provides significant benefits in the short term. A meta-analysis conducted by Hyun et al. (2022) confirmed that hippotherapy and therapeutic horseback riding can reduce lower limb muscle spasticity in children with cerebral palsy (CP) over a short period. The analysis included seven studies that evaluated spasticity using the Ashworth Scale (AS) or the Modified Ashworth Scale (MAS) before and after intervention. Results demonstrated a positive therapeutic effect on lower limb muscle spasticity; however, repeated sessions did not yield statistically significant improvements compared to a single session ( $Q = 2.95$ ,  $P = 0.086$ )<sup>20</sup>.

Other studies also point to improvements in motor function following short-term hippotherapy. For example, a study by Park et al. (2014) demonstrated that an 8-week hippotherapy program led to significant improvements in motor functioning and daily activities, assessed using the PEDI-FSS tool in children with CP<sup>21</sup>.

### **Long-term Effects**

The long-term effects of hippotherapy are also promising. A prospective study conducted by Mutoh et al. (2019) evaluated the impact of a one-year hippotherapy program on walking ability in children with CP. The study included 24 children aged 4–14 years classified as GMFCS level II–III. The program consisted of 30-minute sessions once a week for one year, followed by a 3-month observation period after therapy completion. Results showed improvements in motor functions assessed using the GMFM-66, as well as increases in cadence, stride length, and average acceleration. Furthermore, improvements in gait function and the psychological quality of life of caregivers were sustained for at least three months after the intervention<sup>22</sup>.

## **3. Discussion**

### **3.1. Summary of Research Findings**

An analysis of scientific literature published between 2014 and 2025 clearly indicates that hippotherapy constitutes an effective means of supporting the development of motor functions in children with cerebral palsy (CP). Empirical data from numerous studies reveal statistically and functionally significant benefits resulting from regular participation in therapeutic horseback riding sessions. The most commonly reported effects include improvements in gross motor skills, particularly in balance, postural control, trunk stabilization, and locomotor abilities such as walking, running, and jumping. These changes were especially evident in assessments using tools such as the GMFM-66, GMFM-88, and PEDI-FSS<sup>23, 24</sup>.



Moreover, some studies demonstrated a positive impact of hippotherapy on fine motor skills—particularly in areas related to visuomotor coordination and upper limb precision. Importantly, both short-term and long-term interventions yielded favorable outcomes. The effects were noticeable not only immediately after the completion of the therapy cycle but, in some cases, also persisted over a longer time frame (e.g., three months post-intervention)<sup>25</sup>.

### **3.2. Limitations of the Analyzed Studies**

Despite the clearly positive effects of hippotherapy demonstrated in the reviewed publications, numerous methodological limitations must be acknowledged, as they may influence the interpretation of results. One of the main issues was the relatively small sample sizes in individual studies, limiting the generalizability of conclusions to the broader population of children with CP. In several cases, study groups included fewer than 20 children, which reduces the statistical power of the analyses and increases the risk of random errors<sup>26</sup>.

Additionally, many studies lacked adequately matched control groups or employed them to a limited extent, making it difficult to definitively assess the effectiveness of hippotherapy in comparison with other forms of rehabilitation<sup>27</sup>. Various therapeutic protocols were used—differing in duration, frequency, and session intensity—introducing heterogeneity and complicating comparisons across studies<sup>28</sup>.

It is also worth noting that not all studies included long-term follow-up, which limits the ability to assess the durability of functional improvements. Only a small number of studies conducted follow-up measurements weeks or months after the intervention ended, which highlights a significant gap in hippotherapy research<sup>29</sup>.

### **3.3. Areas Requiring Further Research**

The identified limitations clearly point to the need for further research employing more advanced methodologies in the field of hippotherapy for children with CP. Above all, studies should be designed with larger sample sizes and the inclusion of control groups, which would enhance causal inference<sup>30</sup>.

There is also a need for the standardization of therapeutic protocols to enable meaningful comparison of results and the development of optimal intervention frameworks<sup>31</sup>.

Future research should also incorporate extended follow-up periods to assess the sustainability of therapeutic effects and their influence on the child's and family's quality of life<sup>32</sup>. Furthermore, the potential impact of hippotherapy on other domains—such as emotional, social, and cognitive functioning—should not be overlooked, as therapy involving horses may exert a meaningful influence on these areas as well<sup>33</sup>.

### **3.4. The Role of Hippotherapy as a Support for Motor Therapy in Cerebral Palsy**

Hippotherapy should be regarded as a valuable and complementary tool in the comprehensive treatment of children with cerebral palsy. Its advantage over conventional forms of rehabilitation lies in its dynamic, multisensory nature, which engages not only the musculoskeletal system but also the nervous, sensory, and emotional systems<sup>34</sup>. The rhythmic, three-dimensional movement of the horse facilitates modeling of natural gait patterns and activates deep muscle groups responsible for posture and balance<sup>35</sup>.

Another noteworthy aspect of hippotherapy is the high level of motivation and engagement it fosters in children, which may enhance the overall effectiveness of therapy<sup>36</sup>. Interaction with the animal—often perceived by the child as a "therapy companion"—promotes relaxation,

reduces psychological tension, and fosters the development of a positive therapeutic alliance<sup>37</sup>. For these reasons, hippotherapy should be considered an integral component of therapeutic planning, particularly for children with mild to moderate motor disabilities.

#### 4. Conclusions

The present review of scientific literature from the years 2014–2025 provides compelling evidence that hippotherapy is an effective adjunctive method in improving motor function in children diagnosed with cerebral palsy. Consistent results across numerous studies confirm its beneficial impact on both gross and fine motor skills, particularly in domains such as postural control, balance, trunk stability, and locomotion. These therapeutic effects have been observed both immediately following the intervention and, in some cases, maintained over longer follow-up periods, which emphasizes the potential for lasting improvements.

Despite methodological limitations—such as small sample sizes, lack of control groups, and variability in intervention protocols—the cumulative findings support the integration of hippotherapy into the broader rehabilitation programs for children with CP. The unique, multisensory nature of this therapy, combined with the motivational and emotional benefits it provides, enhances its value within holistic treatment frameworks.

Future research should aim to address current gaps by employing more rigorous study designs, larger sample sizes, and standardized therapeutic protocols. There is also a strong need for long-term follow-up studies and broader evaluations of hippotherapy's effects on cognitive, social, and emotional development.

In summary, hippotherapy holds significant therapeutic promise as a supportive intervention in pediatric neurorehabilitation. When appropriately implemented, it may contribute meaningfully to improving the functional independence and quality of life of children with cerebral palsy.

#### Disclosure

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