

IMPROVING POSTURAL STABILITY THROUGH SIMULATED HIPPO THERAPY IN ADULTS WITH CHRONIC LOW BACK PAIN: A PRACTICAL REHABILITATION APPROACH

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Abstract: Hippotherapy is a form of therapeutic exercise used as a conservative treatment for segmental instability of the lumbar spine and/or hypomobility in individuals with low back pain (LBP). The **aim of the research** was to analyze and demonstrate the effectiveness of simulated hippotherapy in improving postural stability and reducing pain in adults with chronic LBP, through the application of a kinetic program focused on enhancing functionality and balance control. **Research objectives:** To assess the effects of simulated hippotherapy on postural stability and balance control in adults with chronic low back pain; To determine the influence of the simulated hippotherapy program on pain reduction and overall functional improvement in patients. **Research hypothesis:** It is assumed that the application of a structured simulated hippotherapy program, based on rhythmic movements and postural regulation mechanisms specific to this method, will facilitate the reeducation of postural stability in adults with CLBP, contributing to pain reduction and increased overall functionality.

The study included 10 adults with chronic LBP who followed either simulated hippotherapy combined with standard physiotherapy or standard physiotherapy alone. The experimental group showed greater improvement in disability (ODI 34%→20%) and pain (VAS 6.6→3.6; $p=0.034$) compared to the control group (ODI 33%→27%; VAS 6.4→5.3). These results confirm that simulated hippotherapy is an effective complementary method for reducing pain and improving balance, mobility, and functional recovery in patients with chronic LBP.

Keywords: hippotherapy, physiotherapy, back pain, postural control

Introduction

The World Health Organization recognises the global burden of disease associated with low back pain and other musculoskeletal conditions, emphasizing the need for accessible rehabilitation services and the implementation of evidence-based guidelines in primary and community care settings (WHO, 2023). Chronic low back pain represents a multifactorial condition that encompasses nociceptive, neuropathic, and nociplastic components, often overlapping. The lumbar spine is particularly vulnerable to mechanical and inflammatory stressors, and due to the low specificity of imaging techniques, diagnosis and management remain complex (Iqbal, 2011). In recent years, the biopsychosocial model has gained prominence, framing low back pain as the result of the dynamic interaction between biological, psychological, and social factors (Roșca et al., 2023). Consequently, treatment strategies increasingly integrate non-pharmacological methods such as physical therapy, exercise, and cognitive-behavioral

approaches, aiming to address both functional and psychosocial dimensions of the disorder (Shurtleff et al., 2009).

Within this context, hippotherapy has emerged as a complementary and innovative form of rehabilitation. It is a therapeutic approach in which physical, occupational, or speech therapists use the horse's characteristic three-dimensional movement to provide graded motor and sensory input (Koca & Ataseven, 2016). Unlike therapeutic horseback riding, which focuses on developing equestrian skills, hippotherapy employs the horse's motion as a treatment tool to enhance postural control, balance, coordination, and sensory integration (Darii, 2024). The rhythmic and repetitive nature of equine movement closely simulates human pelvic kinematics during walking, facilitating neuromuscular re-education and improved motor patterns (Roa & Rodríguez, 2015). Conducted in a controlled environment, the therapist modulates the horse's gait and sensory stimuli to achieve specific therapeutic objectives, thereby

establishing a foundation for improved neurological function and sensory processing that can be generalized to daily life activities (Meregillano, 2004).

Hippotherapy has been applied in a wide range of neurological and musculoskeletal conditions, including cerebral palsy, multiple sclerosis, stroke, traumatic brain injury, spinal cord injury, arthritis, autism, and behavioral or psychiatric disorders. Although clinical studies have reported encouraging results, the scientific evidence regarding its effectiveness remains heterogeneous, highlighting the need for further high-quality research and standardized protocols (Rahbar et al., 2018).

In the context of chronic low back pain, hippotherapy—either traditional or simulated—may offer an effective adjunct to conventional physiotherapy programs (Gámez Calvo et al., 2021). Through the improvement of axial stability, proprioceptive feedback, and neuromuscular coordination, this method supports the restoration of functional movement and postural control, contributing to pain reduction and enhanced quality of life (Appeadu & Gupta, 2023). Its integration within multidisciplinary rehabilitation strategies aligns with the WHO recommendations for non-surgical, movement-based management of chronic musculoskeletal disorders, emphasizing function-oriented and patient-centered care.

Materials and methods

The aim of the research is to analyze and demonstrate the effectiveness of simulated hippotherapy in improving postural stability and reducing pain in adults with chronic low back

pain, through the implementation of a kinetic program focused on enhancing functionality and balance control.

Objectives:

1. To evaluate the effects of simulated hippotherapy on postural stability and balance control in adults with chronic low back pain.

2. To determine the influence of the simulated hippotherapy program on reducing pain intensity and improving the overall functionality of patients.

Research hypothesis. It is assumed that the application of a structured simulated hippotherapy program, based on rhythmic movements and the postural regulation mechanisms specific to this method, will facilitate the re-education of postural stability in adults with chronic low back pain, contributing to pain reduction and improvement of overall functionality.

The study has an experimental, prospective, and controlled design with two parallel groups and a pretest–posttest structure, aiming to evaluate the effectiveness of simulated hippotherapy in improving postural stability in adults with chronic low back pain. Ten adults aged 45–65 years were included and equally assigned to the experimental group (n=5), which received simulated hippotherapy integrated into the rehabilitation program, and the control group (n=5), which followed standard physiotherapy. All participants were enrolled voluntarily, provided informed consent, and the study protocol was approved by the ethics committee. The general characteristics of the participants are presented in Table 1, supporting baseline comparability and the validity of the study design.

Table 1. Description of the study groups

Nº	Indicators	Grupul experimental (n=5)	Grupul control (n=5)
1.	Age	45 – 65 years	45 – 65 years
2.	Gender	3 F	4 F
		2 M	1 M

All subjects were assessed and enrolled based on standard clinical criteria for non-specific chronic low back pain. The interventions were carried out in two complementary settings: (1) the Clinical Hospital for Rehabilitation and Chronic Care, where clinical evaluations and the standard physiotherapy and physical therapy program were conducted; and (2) the Republican School of Equestrian and Modern Pentathlon, where simulated hippotherapy sessions were performed exclusively for the experimental group.

The experimental group participated in simulated hippotherapy sessions lasting 25–30 minutes, followed by standard physiotherapy and physical therapy sessions lasting 45–60 minutes. The simulated hippotherapy protocol included three-dimensional pelvic movements, anterior–posterior and medio–lateral weight transfers, controlled trunk rotations, and “reaching”/“dual-task” exercises, with individualized progression (Table. 2).

Table 2. Intervention protocols (Dosage and Content)

Group	Session content	Duration/session	Frequency
Experimental	Simulated hippotherapy + Physiotherapy & physical therapy	25–30 min + 45–60 min	3×/week
Control	Physiotherapy & physical therapy (without hippotherapy)	45–60 min	3×/week

The control group followed only the standard physiotherapy and physical therapy program, with sessions lasting 45–60 minutes, without the hippotherapy component. The standard program included lumbopelvic stabilization exercises, targeted stretching of relevant muscle groups (e.g., hamstrings, psoas), and postural education; physiotherapy modalities (e.g., TENS, superficial thermotherapy) were applied as indicated, under identical conditions for both groups.

The participants were evaluated using a standardized assessment battery, which included the Visual Analogue Scale (VAS) for pain intensity, the Oswestry Disability Index (ODI) for lumbar disability, the modified Clinical Test of Sensory Interaction on Balance (mCTSIB) for postural control, the Y-Balance Test for dynamic balance and asymmetry, and the Timed Up and Go (TUG) test for functional mobility.

In figure 1 illustrates the structured methodology of the physiotherapeutic program applied in the study. The process was divided into four stages: initial evaluation, implementation of the six-week kinetic program, intermediate reassessment (week 3), and final reassessment (week 6).

During Stage I, participants underwent baseline evaluation using standardized instruments: the Visual Analogue Scale (VAS) for pain intensity, the Oswestry Disability Index (ODI) for the level of disability, the Y-Balance Test for balance and postural control, and the Timed Up and Go (TUG) test for functional gait speed.

Stage II involved the six-week implementation of the kinetic program. The experimental group (EG) performed simulated hippotherapy combined with physiotherapeutic exercises, structured into four modules: (1) warm-up and neuromotor preparation (5–10 minutes), (2) simulated

hippotherapy (25–30 minutes), (3) lumbopelvic stabilization exercises (30–40 minutes), and (4) stretching and recovery (10 minutes). The control group (CG) followed a conventional physiotherapy program of equivalent duration without the hippotherapy component.

Finally, Stage III and Stage IV included intermediate and final reassessments (at weeks 3 and 6, respectively), enabling comparison of functional progress and postural stability outcomes between groups.

Results

Following the implementation of the six-week structured kinetic program, clear differences were observed between the experimental group, which received simulated hippotherapy integrated into the physiotherapy sessions, and the control group, which followed only conventional physiotherapy. The comparative analysis focused on four key indicators: pain intensity (VAS), functional disability (ODI), postural balance (Y-Balance Test), and functional mobility (TUG).

Results revealed a significant reduction in VAS scores in the experimental group, decreasing from a mean of 6.6 to 3.6 points, compared with a more modest decrease in the control group, from 6.4 to 5.3 points (Tab. 3). This marked reduction suggests a clear analgesic effect of simulated hippotherapy, likely resulting from the rhythmic, three-dimensional movements that modulate muscle tone and restore postural control mechanisms. Through proprioceptive and vestibular feedback, exercises performed on a therapeutic ball contributed to reducing segmental stiffness and relaxing the paravertebral musculature, facilitating efficient neuromotor reorganization.

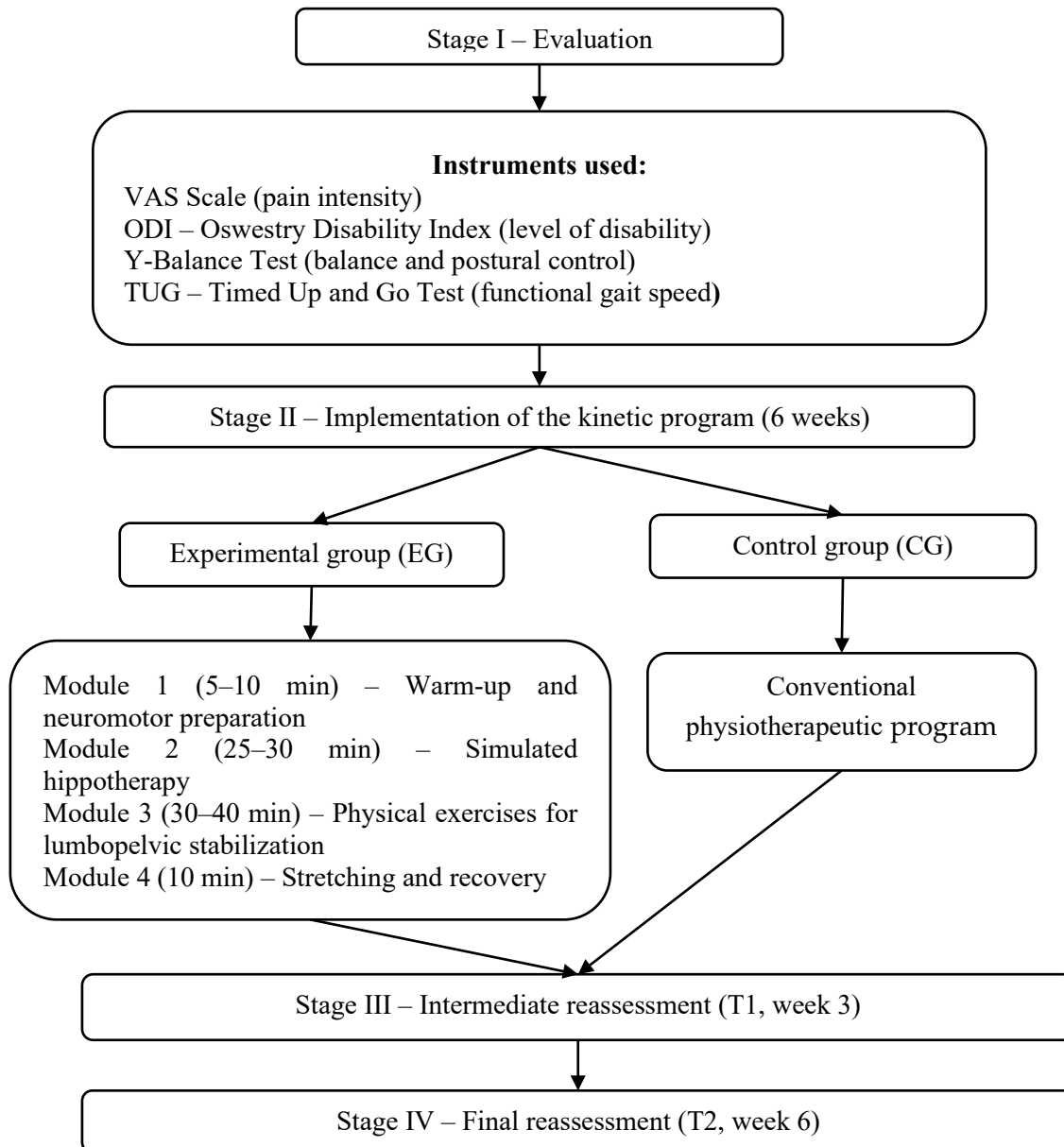


Figure 1. Methodological design of the physiotherapeutic intervention

At the end of the program, ODI scores improved markedly in the experimental group, decreasing from 34% to 20%, while the control group showed a smaller improvement, from 33% to 27%. Although the difference did not reach statistical significance (Tab. 3), the magnitude of change supports the positive impact of posture-oriented and functional exercises. The reduction in ODI reflects improved capacity among experimental group participants to perform activities of daily living, attributable to enhanced axial stability and reduced effort-related pain. Regarding functional balance, mean Y-Balance scores increased notably in the experimental group, from 85.2% to 92.4%, compared to a

smaller increase in the control group, from 84.7% to 86.1%. Although the statistical difference (Table 3), was not strictly significant, the change magnitude indicates a clear improvement in postural control following simulated hippotherapy. The oscillatory three-dimensional movements stimulated automatic postural reactions and trunk adaptations to balance changes, training both vestibular and proprioceptive systems. This improvement reflects the body's enhanced capacity to integrate sensory information into efficient motor strategies, thereby reducing imbalance and the recurrence of pain.

Table 3. Comparative results between the experimental and control groups at baseline (T0) and after intervention (T2)

Test	EG T0 (Mean±SD)	EG T2 (Mean±SD)	CG T0 (Mean±SD)	CG T2 (Mean±SD)	p (EG vs CG at T2)
	Experimental Group (n=5)		Control Group (n=5)		
	Initial Evaluation	Final Evaluation	Initial Evaluation	Final Evaluation	p
VAS (0–10)	6.6±1.0	3.6±1.1	6.4±1.1	5.3±1.0	.034
ODI (%)	34.0±8.0	20.0±7.0	33.0±7.0	27.0±6.0	.129
Y-Balance (LL) – composite (%)	85.2±6.0	92.4±5.5	84.7±5.8	86.1±5.7	.113
TUG (sec)	9.4±1.1	7.8±0.9	9.3±1.0	8.8±0.9	.117

The TUG test results confirmed the general trend of improvement. The experimental group's execution time decreased from 9.4 to 7.8 seconds, whereas the control group improved from 9.3 to 8.8 seconds (Tab. 3). Faster and smoother transitions in posture and gait denote better coordination and dynamic trunk control. These outcomes align with increased activation of the pelvic stabilizing musculature and optimization of neuromotor strategies trained through simulated hippotherapy.

The overall analysis demonstrates that including simulated hippotherapy in the kinetic program produced significant improvements in both objective parameters and patients' subjective perception of well-being. The reduction of pain, enhanced postural stability, and improved functional mobility were direct outcomes of the therapeutic algorithm combining simulated hippotherapy (module 2) with lumbopelvic stabilization exercises (module 3) and coordination and balance training (module 4).

By applying progressive load adjustment and clear safety criteria (axial control ≥ 30 seconds, pain ≤ 4 on the VAS, moderate perceived fatigue), the program allowed gradual adaptation to effort, preventing painful responses while reinforcing neuromotor control mechanisms. Consequently, simulated hippotherapy functioned not only as an analytical mobilization method but also as an integrative link between the sensory and functional components of the rehabilitation process.

Discussion

The results obtained confirm the research hypothesis, according to which the application of a kinetic program based on simulated hippotherapy facilitates the re-education of postural stability and contributes to pain reduction

and improved overall functionality in adults with chronic low back pain. The effectiveness of the method can be explained by the controlled stimulation of postural reflexes and balance reactions through the coordinated involvement of the neuromuscular, vestibular, and visual systems. Through the rhythmic and complex nature of its movements, simulated hippotherapy ensures the active integration of the trunk into the body schema, enhancing segmental perception and global motor control. In this regard, the findings are consistent with international studies that describe hippotherapy as an effective form of neuromotor training in postural instability and chronic low back pain.

Conclusion

The obtained results confirm the effectiveness of the kinetic program that integrated simulated hippotherapy into the neuromotor re-education of patients with chronic low back pain.

The significant reduction in pain intensity, the improvement of postural balance, and the increase in functional mobility demonstrated the value of this method in restoring axial stability and reducing functional limitations. Compared to conventional physiotherapy, the intervention based on rhythmic tridimensional movements provided a more complex sensorimotor stimulus, promoting the reorganization of postural control and the optimization of adaptive trunk responses.

The effectiveness of the proposed program supports the use of simulated hippotherapy as a complementary therapeutic tool capable of improving functional performance and quality of life in individuals with chronic low back pain, justifying the expansion of research on larger samples and in diverse clinical contexts.

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