



A Review of Efficacy of Hippotherapy for the Treatment of Musculoskeletal Disorders

Antonios G. Angoules^{1*}, Dionysios Koukoulas², Konstantinos Balakatounis³,
Irene Kapari⁴ and Eleni Matsouki⁴

¹Department of Medical Laboratories, Technological Educational Institute of Athens, Greece.

²Department of Physical Therapy, Technological Educational Institute of Athens, Greece.

³Philoktitis-Egersis Physical Medicine Center of Excellence, Athens, Greece.

⁴Hellenic Association for Therapeutic Riding (ELETHIP), Athens, Greece.

Authors' contributions

This work was carried out in collaboration between all authors. Author AGA designed the study, wrote the protocol, and wrote the manuscript. Authors DK, KB, IK and EM managed the literature searches, analysis of the study results and helped in arranging references. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/17023

Editor(s):

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Complete Peer review History: <http://www.sciencedomain.org/review-history.php?iid=1116&id=12&aid=8985>

Review Article

Received 23th February 2015

Accepted 6th April 2015

Published 27th April 2015

ABSTRACT

Objective: Hippotherapy or Equine Assisted Therapy (EAT) is an alternative therapeutic treatment which is based on the special benefits of horse riding. The purpose of the herein review is to investigate the efficacy of this method for the treatment of several dysfunctions affecting the musculoskeletal system.

Materials and Methods: International literature was thoroughly studied, with special focus on indications and therapeutic effectiveness of this method in injuries and diseases of musculoskeletal interest.

Results: EAT seems to contribute positively to spasticity reduction, following spinal cord injuries (SCIs) and affects the overall patients' quality life. It also acts positively on the prevention of falls in

*Corresponding author: Email: antoniosangoules@yahoo.com;

the elderly. Less evidence exists on the usefulness of this method in scoliotic curvature reduction in children with cerebral palsy (CP) and in treatment of Low back Pain (LBP).

Conclusion: Hippotherapy improves muscle strength, balance and coordination of movement and it also contributes to relaxation and control of posture. Thus, it seems that as a supplementary method, accompanying other individualized therapeutic approaches, it can address a number of problems of the musculoskeletal system. More and well-designed studies are needed to draw firm conclusions about the benefits and the indications of the method.

Keywords: Equine assisted therapy; falls; elderly; spinal cord injury; spasticity; functional scoliosis; low back pain.

1. INTRODUCTION

Hippotherapy also called Equine Assisted Therapy (EAT) is a physical therapy treatment which is a specially modified technique of horse riding oriented to certain therapeutic purposes. The term originates from the Greek word "Hippos", that means horse, the essential healing tool characterizing this therapeutic modality [1].

As a popular therapeutic approach that aroused the last years, hippotherapy is thought to function through balance and coordination neural circuits, since some essential adaptations of the patient's movement are forced to be expressed by the movement of the horse [2]. Hippotherapy is believed to promote neuromuscular coordination, through the impulses of the walking horse that are carried as stimuli to the rider's central nervous system. It has been proposed that this method utilises the repetitive locomotion pattern of the horse which imitates the ambulating gait of humans [2].

The most important target actions, according to the supporters of the method are thought to be beneficial for muscle tone and joint problems at and around the pelvic area, as well as for the development and the improvement of posture and balance functional mechanisms of the body [3].

These results are achieved by placing the patient, which is often a child, in different positions on the horse such as prone, side lying, or sitting, while the therapeutic riding is usually performed with the rider on a sheepskin or soft pad rather than a saddle. With this modification the rider can have a better sense of the movement and temperature of the horse. This modification allows the warmth and movement of the walking horse to be imparted to the rider [3]. It is worth mentioning that the temperature of the horse surpasses that of a human, which is beneficial in muscle tone and spasticity

reduction, clinical signs that often characterize participants' general clinical appearance [4].

Not only the movement of the horse is utilized during an hippotherapy session, but also the barn, farm and psychosocial environment, as a whole, provide positive impulses to the patient's functional systems enabling the participant to accomplish specific therapeutic goals [1].

The effectiveness of hippotherapy, as a treatment for neurological disorders, has been extensively and variously supported by literature. Thus, unpublished data and a number of studies support the benefits of hippotherapy for people with CP specifically as regards balance education, as well as, head and trunk control improvement [1,5]. Furthermore, numerous papers present positive results in cases where hippotherapy was used as an accessory treatment modality, in multiple sclerosis (MS) [6,7]. However, the application of the method in treating various musculoskeletal disorders has not been extensively studied.

We have therefore performed a systematic review of the literature in order to investigate the existing evidence related to the methods and the extend in which hippotherapy improves musculoskeletal dysfunctions, to the pathologies that it can successfully treat, to the part of the population that it is advisable to be applied and lastly, to the final outcome and the general improvement of the patients.

2. MATERIALS AND METHODS

Publications related to the management of musculoskeletal pathologies utilising hippotherapy were identified through a Medline database search, published between January 1990 and October 2014, using "hippotherapy", or "equine assisted therapy", and "musculoskeletal", or "orthopaedic", or "spinal cord injury", or "fall", or "elderly" as keywords

and with MeSH (Medline/PubMed's article indexing terminology) subject headings.

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Only papers in English language concerning the application of hippotherapy in musculoskeletal disorders and more specifically spinal cord injuries (SCI), low back pain (LBP) and neck pain, falls in the elderly and functional scoliosis were included. Full articles were retrieved and assessed for their suitability for review. Articles were considered eligible only if complete documentation of applied hippotherapy treatment and the final outcome were both encompassed.

Case reports and case series were included in this study for the purpose that all related published data is included.

Based on the search strategy the electronic search retrieved 125 potentially eligible papers. 9 of them met the inclusion criteria [4,8-15]. A total of 147 patients were included for the final analysis.

3. RESULTS

3.1 Spinal Cord Injuries (Tables 1, 2)

Spinal cord injury is a major health problem associated with devastating consequences and high incidence of comorbidity [16,17]. Spasticity is a well recognized muscle tone aberration, which is present after SCI [17]. In accordance to its severity, patient's functional independence has not the same clinical appearance in every case.

Table 1. SCI-demographics

Author/year	Patients	Male	Female	Age (mean age, y)
Lechner et al. 2003 [15]	32	28 (87.5 %)	4 (12.5 %)	16-72 (37)
Lechner et al. 2007 [14]	11	11 (100 %)		27-68 (44)
Asselin et al. 2012 [4]	1	1 (100 %)		(44)
Total	44	40	4	

SCI = Spinal cord injury

Table 2. SCI – hippotherapy parameters

Author/year	N	Intervention	Evaluation Method	Outcome
Lechner et al. 2003 [15]	32	11 (range: 5–24) hippotherapy sessions, 25–30 min/session	Ashworth Scale	Spasticity reduction
Lechner et al. 2007 [14]	11	Hippotherapy vs Sitting astride a Bobath roll or on a rocking seat 4 weeks/ twice weekly sessions, 25 min/session	Ashworth Scale, Visual Analogue Scale (VAS) Self-rated well-being scale (Befindlichkeits Skala)	Spasticity significant reduction compared with the control group, Positive short-term effect on mental well-being
Asselin et al. 2012 [4]	1	2 years hippotherapy sessions	Qualitative Data	Physical and emotional benefits
Total	44			

SCI = Spinal cord injury; N = number of patients

Hippotherapy and therapeutic horseback riding has been proved to be an effective rehabilitation method which promotes relaxation in spastic cerebral palsy (CP) [5]. The rationale is based on the warmth of the horse coupled with the rhythmical movement pattern performed, which condenses muscle spasticity and promotes relaxation in children with CP [3].

A few Randomized Control Trials (RCTs) assessed the short-term effects of hippotherapy on spasticity in patients with SCI.

Lechner et al. [15] in 2003 evaluated muscle tone of lower extremities in 32 individuals with SCI, before and after hippotherapy, using the Ashworth Scale. They were able to confirm that SCI patients showed significantly lower Ashworth values after the treatment, with better results noted in cases with increased spasticity. No significant difference between short-term effect in paraplegic and short-term effect in tetraplegic participants were recorded.

In another more recent crossover trial in 2007, Lechner et al. [14] assessed 11 SCI patients with spasticity, who participated EAT sessions that lasted 25 minutes, and took place twice a week for 4 weeks versus a control group sitting astride a Bobath roll, and sitting on a stool with rocking seat. Both clinical and self-rating scores revealed significant reduction of spasticity in the intervention group, compared to the control group. A positive short-term effect on subjects' mental well-being was also reported.

Finally, in a case study a 44-year-old male non ambulatory veteran with an established incomplete spinal cord injury, followed a nationwide therapeutic riding program for America's wounded service veterans [4]. After a period of two years, he was able to obtain considerable physical, emotional and social benefits.

Although the existing data support the alleviation of symptoms relating muscle spasticity in SCI patients participating in horse riding programs, further investigation is needed to establish the frank effects of this therapeutic intervention and its benefits upon other applied treatment modalities.

3.2 Back and Neck Pain

LBP is a world spread ailment associated with high economic burden comparable to nosological

entities such as headache, heart disease and diabetes mellitus [18,19]. The point prevalence of low back pain has been estimated equal to 12%, with a 1-month prevalence around 23% [20].

A plethora of conservative such as pharmacological or physical therapy and invasive curative interventions have been used for chronic LBP management [21]. Equine assisted therapy is an alternative therapeutic modality proposed for the treatment of this complex physical disability.

Orthopedic Horseback-Riding-Therapy (OHRT), is an approach introduced by Rothhaupt and his co-workers [22,23]. The method is based on the concept of conveying to the patient the three-dimensional swinging motion of the horse's back. The aforementioned researchers assessed OHRT in a prospective RCT, studying postoperative rehabilitation in patients who underwent lumbar discectomy in comparison to a pathology-related equivalent control group. In this trial OHRT was proved an efficient method in postoperative treatment of patients that underwent the aforementioned surgical procedure [22], as it improves not only the patients' self evaluation on their postoperative condition but it also reduces significantly the limitations arising in the working environment, always in comparison with the control group.

The effect of an EAT program was evaluated in a total of 24 patients with neck and back pain, which resulted in substantial disability in their daily activities. Their health was also severely affected by concomitant somatic and psychiatric comorbidities [13]. EAT, as a body-awareness oriented treatment managed to reduce pain and had also a sedative effect on the other symptoms. Moreover the patient's self-image was beneficially influenced.

It is obvious that there is lack of evidence based studies assessing the effect of therapeutic riding on low back pain. Further investigation is mandated in order to derive safe conclusions about the efficacy of this method.

3.3 Falls in the Elderly (Tables 3, 4)

Falls in the elderly constitute a major socioeconomic problem since they are accompanied by significant morbidities and mortality rates [24-27]. They are the main cause of osteoporotic fractures in the elderly such as hip and wrist, but they are also responsible for

head injuries in that age [28]. The main cause of falls, appear to be abnormalities of the motor system that result to disorders in equilibrium and gait mechanism [24,28]. A significant percentage of disability is attributed to the aforementioned injuries, and resuscitation is deficient in the vast majority of cases [29]. As a result, the prevention of falls in this population group is of paramount importance since it can contribute significantly to the overall improvement of health status and to a general reduction in the field of morbidity.

De Araujo et al. [10] conducted a prospective randomized study including 28 elderly volunteers over 60 years of age. The experimental group participated in an 8-week hippotherapy program. Several functional tests were applied in both groups. Lower limb strength and balance was improved in the experimental group in comparison to the control group.

The effect of therapeutic riding on postural balance alterations was studied in another randomized trial using a force platform [12]. This study involved 17 older adults, divided into experimental and control groups in which stabilometric parameters were analysed. After 16 sessions of EAT, no significant changes in postural balance were detected.

A single-group trial included 9 elderly subjects with mild to moderate balance deficits, aged from 71 to 83 years, joined an 8-week therapeutic riding (TR) program, followed by another 8-week observation period [9]. The effect of this intervention on patients balance and quality of life was calculated using the Fullerton Advanced Balance Scale (FABS), and the Rand SF (short form) 36 scale. TR improved scientifically balance score and perception of general health from the start to the end of the intervention period, proving its usefulness.

Finally in a recent prospective study 22 subjects, at least 65 years old, were randomly divided into a hippotherapy group and a treadmill group and they exercised in 20-minute sessions, three times per week for 12 weeks [8]. Step lengths increased significantly, and step time and sway path lengths significantly decreased in both groups after the intervention with the hippotherapy group showing statistically significant results.

Conclusively there is promising evidence that hippotherapy promotes balance in the elderly contributing in fall prevention. Further high-quality randomised controlled trials may assist in the evaluation of the utility of EAT to ease risk factors of falls and fall-induced injuries in aged people.

3.4 Functional Scoliosis

Scoliosis is not rare spinal deformity in Cerebral Palsy (CP). Its incidence in the overall CP population is estimated as high as 20-25% [30,31]. Even though the cause of this abnormality is not clearly recognized, it is attributed to a combination of muscle weakness, truncal imbalance, and asymmetric tone in paraspinal and intercostal muscles [30].

The evidence about the effectiveness of EAT in functional scoliosis following cerebral palsy is sparse. Ihara et al. [11] presented the first report of the effectiveness of horse riding on functional scoliosis in 3 cases of 3 children 8-14 years old with CP and spina bifida. After participating in therapeutic riding from 1 to 3 years the confirmed by roentgenography scoliotic curvature profoundly improved in all patients until 17°.

Based on the existing research, it is clear that TR cannot be safely recommended for the treatment of functional scoliosis associated with CP. However further scientific research may reveal the weighted value of the method.

4. DISCUSSION

Hippotherapy represents an alternative method of physical rehabilitation which arises a growing interest of the international scientific community. The application of this method is based on the transmission of rhythmical and three dimensional movement of the horse to the patient. This movement resembles the movement of the human pelvis during walking. It enables the transmission of stimuli which contribute to the reduction of spasticity and improvement of the postural control and balance of the patient. Several environmental factors have also an important effect, like the environment where the treatment takes place and the relationship that develops between the horse and the patient [32].

Table 3. Falls in the elderly-demographics

Author/year	Patients	Male	Female	Age (mean age, y)
Araujo et al. 2011[12]	17 experimental:7, control:10	E: 2 (28.6%)	E: 5 (71.4%)	60-84
Homnick et al. 2013 [9]	9	4 (44.4%)	5 (55.6)	71–83 (76.4)
de Arajo et al. 2013 [10]	28 experimental:12, control:16	E: 4 (33.3%) C: 2 (12.5%)	E: 8 (66.7%) C:14 (87.5%)	60-84
Kim and Lee 2014 [8]	22 experimental:11, control:11	E: 5 (45.5%) C: 7 (63.6%)	E:6 (54.5%) C:4 (36.4%)	E: 70.3±3.4 C: 68.5±3.2
Total	76			

E = Experimental; C = Control

Table 4. Falls in the elderly – hippotherapy parameters

Author/year	N	Intervention	Evaluation Method	Outcome
De Araujo et al. 2013 [10]	28 E:12 C:16	8-week hippotherapy sessions/ twice a week, 30 min/session	Time Up and Go Test (TUG) Chair Stand Test (30CST) Berg Balance Scale (BBS)	Balance improvement, Lower limb muscle strength improvement
Araujo et al. 2011 [12]	17 E:7, C:10	16 hippotherapy sessions/ twice a week, 30 min/session	Stabilometry	Significant improvement in Timed Up and Go (TUG) test scores
Homnick et al. 2013 [9]	9	8-week hippotherapy sessions/ 1 hour per week	Fullerton Advanced Balance (FABS) scale, Rand SF (short form) 36 quality-of-life survey	Balance improvement, Quality of life improvement
Kim and Lee 2014 [8]	22	Hippotherapy vs Treadmill exercise 8 -week hippotherapy and treadmill sessions/ three times per week, 20-min/ session	Stabilometry	Step length significant increase, Step time and sway path length significant decrease in both groups Larger decreases in sway path lengths compared with the control group
Total	76			

N = Number of patients; E = Experimental; C = Control;

A series of papers endorse the effectiveness of the method in treating various neurological diseases in children and adults. Thus hippotherapy proves to be decisive in muscle tone reduction and mobility improvement in conditions such as CP and MS. Although the efficacy of this non operative approach in the field of neurological rehabilitation is well documented, the therapeutic value of the method in the treatment of cases involving orthopedic rehabilitation has not been adequately studied. Regardless of the aforementioned fact, according to the existing literature it appears that hippotherapy can contribute to addressing a range of injuries and diseases of the musculoskeletal system (Table 5).

EAT seems to be particularly beneficial in patients with SCI. In this case it contributes to reducing the symptoms of spasticity that accompany these serious injuries and it can improve general psychological and social health of the patient. However further future research is warranted to ascertain whether EAT is a cost-effective method and the degree in which it bears results in comparison with the current SCI curative interventions.

Another ailment where EAT appears to have a positive physical effect is functional scoliosis following cerebral palsy. There is some evidence that the scoliotic curvature which often accompanies these children is reduced although

Table 5. Summary table

Study Researchers	Year	Type of musculoskeletal disorder	Evaluation - methods	N	Results
Lechner et al. [15]	2003	SCI	Ashworth scale	32	Spasticity reduction
Lechner et al. [15]	2007	SCI	Ashworth scale, Visual Analogue Scale (VAS) Self-rated well-being scale (Befindlichkeits Skala)	11	Spasticity significant reduction compared with the control group, Positive short-term effect on mental well- being
Asselin et al. [4]	2012	SCI	Qualitative data	1	Physical and emotional benefits
Hakanson et al. [13]	2009	Neck and Back Pain	Visual analogue scale (VAS), video recordings	24	Pain reduction, Increased body awareness and self -esteem
De Araujo et al. [10]	2013	Falls in the Elderly	Time Up and Go Test (TUG), Chair Stand Test (30CST), Berg Balance Scale (BBS)	28	Balance improvement, Lower limb muscle strength improvement
Araujo et al. [12]	2011	Falls in the Elderly	Stabilometry	17	Balance improvement
Homnick et al. [9]	2012	Falls in the Elderly	Fullerton Advanced Balance (FABS) scale, Rand SF (short form) 36 quality- of-life survey	9	Balance improvement, Quality of life improvement
Kim and Lee [8]	2014	Falls in the Elderly	Stabilometry	22	Balance improvement
Ihara et al. [11]	2012	Functional Scoliosis	Roentgenograph y	3	Scoliotic Curvature Improvement
Total				147	

SCI = Spinal Cord Injury; N = number of patients

the existing data is not adequate to safely support this conclusion.

Hippotherapy is a proprioceptive neuro-muscular facilitation method [33]. Stabilometric methods and postural evaluation scales support that hippotherapy can improve static and dynamic balance and contribute to the prevention of falls in the elderly and their severe consequences.

As far as the usefulness of the method in the treatment of LBP of mechanical etiology, a common health problem of particular socio-economic importance, there is no evidence about the scientific value of this therapeutic strategy.

5. CONCLUSION

In conclusion, more well-designed studies are required to reach to safe conclusions about the position of hippotherapy in the treatment of the abovementioned health problems. Also, more qualitative research should be performed to assess the advantages of this method and its cost effectiveness compared to other physical methods of treatment of these diseases.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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