

Therapeutic effects of hippotherapy in the elderly: a review of the literature

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Summary

The present work aims to carry out a structured and bibliographic review based on the results found regarding the terms Hippotherapy and Elderly people. For the reference search, the following keywords in English, Hippotherapy and Elderly, were used as descriptors, these keywords being always entered in databases of the same language. The computerized databases SCOPUS, WOS, SPORTDiscus were used. PubMed and Cochrane. To limit the search for documents, four inclusion criteria were introduced: i) Mention at least some of the characteristics of Hippotherapy for the elderly (minimum 20 words that mention the subject), ii) Select only scientific documents (journal articles) These articles may have an experimental design or be review articles, iii) Be accessible and be available in full text or with access to the abstract, and iii) Be written in Spanish, English or Portuguese. The results show that the papers on Hippotherapy in the elderly address different research topics and show that equestrian therapies have beneficial therapeutic effects in the elderly population. Hippotherapy interventions improve static balance and dynamic balance, postural balance, functional mobility, flexibility, muscular strength, gait and cadence of steps. They reduce spasticity, causing a decrease in the risk of falls and an improvement in the quality of life of the elderly. In addition, they cause benefits on a psychological level, reducing levels of stress and depression, which produces an improvement in the quality of sleep and positively influences mood.

Key words:

Hippotherapy. Elderly people.
Benefits.

Efectos terapéuticos de la hipoterapia para personas mayores: revisión de la literatura

Resumen

El presente trabajo tiene por objetivo realizar una revisión bibliográfica y estructurada basada en los resultados encontrados en torno a los términos *Hipoterapia* y *Personas mayores*. Para la búsqueda de referencias, se utilizó como descriptores las siguientes palabras clave en inglés, *Hippotherapy* y *Elderly*, siendo estas palabras clave siempre introducidas en las bases de datos del mismo idioma. Se utilizaron las bases de datos informatizadas SCOPUS, WOS, SPORTDiscus, PubMed y Cochrane. Para limitar la búsqueda de documentos, se introdujeron cuatro criterios de inclusión: i) Mencionar al menos alguna de las características de la Hipoterapia para personas mayores (mínimo 20 palabras que mencionen la temática), ii) Seleccionar solamente documentos científicos (Artículos de revistas), pudiendo tener estos manuscritos un diseño experimental o ser estudio de revisión, iii) Ser accesible y estar disponible a texto completo o con acceso al resumen, y iii) Estar escrito en el idioma español, inglés o portugués. Los resultados muestran que los documentos sobre Hipoterapia en personas mayores abordan tópicos de investigación diferentes, y muestran que las terapias ecuestres tienen efectos terapéuticos beneficiosos en la población de edad avanzada. Las intervenciones con Hipoterapia mejoran el equilibrio estático y el equilibrio dinámico, el equilibrio postural, la movilidad funcional, la flexibilidad, la fuerza muscular, el modo de andar y la cadencia de pasos. Disminuyen la espasticidad, provocando una disminución del riesgo de caída y una mejora de la calidad de vida de las personas de edad avanzada. Además, provocan beneficios a nivel psicológico, reduciendo los niveles de estrés y depresión, lo que produce una mejora en la calidad del sueño e influye positivamente en el estado de ánimo.

Palabras clave:

Hipoterapia. Personas mayores.
Beneficios.

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Introduction

Animal-assisted therapies, specifically with horses, are officially practised almost everywhere in the world¹, as a therapeutic alternative within the areas of rehabilitation and re-education. This is a specialised work methodology², that has shown improvements in the quality of life and general state of health of individuals³, by providing psychological, social and educational benefits that improve the performance of daily activities^{4,5}. To conduct this technique, the horse first needs to be trained and must also have a docile nature so that it can be approached by, and come into contact with people who may have behavioural disorders, involuntary movements or who use some kind of device (walking stick or wheelchair), conditions which could scare an untrained horse⁶. It is therefore a direct intervention with some pre-designed goals, for the purpose of achieving physical, social, emotional and cognitive benefits, individually or in a group of persons with different abilities, taking advantage of the characteristics of the animals.

Furthermore, studies have also reported evidence of the effectiveness and benefits of Hippotherapy in different groups of disabled persons, such as with cerebral palsy^{7,8}, psychomotor retardation⁹, multiple sclerosis¹⁰, Down syndrome¹¹, or the elderly^{4,12,13}, among others. Hippotherapy is a comprehensive, neurologically based, multi-disciplinary treatment that uses the horse as its main element, taking advantage of its qualities (movement, rhythm and heat) to stimulate multiple psychomotor and sensory areas^{9,14}. It has therefore become an effective intervention, and there is increasing scientific evidence of its benefits, acting across the board in the social, physical and intellectual sphere of participants¹⁵.

On the other hand, ageing is a natural, inevitable process¹⁶. Population growth together with increased life expectancy is leading to a considerable increase in the number of elderly persons in developing countries¹⁷, causing an increase in chronic ageing-related diseases¹⁸. As a result, the ageing process entails biological, cognitive and social changes, with the progressive presence of molecular and cellular damage¹⁹, as well as a loss of muscle power and strength²⁰. These factors can cause an alteration of physical functions that have a negative impact on the functional daily life skills, and usually accompanied by a concern for the cognitive change occurring²¹, as well as frame of mind²².

Given the scarcity of review documents on this subject, and analysing the different databases, a new review of the literature to complete the state-of-the-art with regard to investigations into the use of Hippotherapy in the elderly and to provide conclusions on the benefits of equine therapies for this group, was considered to be of interest.

Material and method

Design

This investigation comes within theoretical studies. For this purpose, a search and compilation process was made of scientific documents

using the "Data accumulation and study selection" model²³, in order to analyse the articles published in relation to the benefits of Hippotherapy in the elderly.

Sample

The sample consisted in articles from scientific journals. From a total of 1292 articles in the initial phase of the search, conducted in October 2020 among the three databases, using *Hippotherapy* as the first term selected, 1243 articles were subsequently rejected after including the second term *Elderly*. 15 documents were then selected, which met the inclusion criteria pre-established by the investigators.

Criteria for the selection of studies

For the document search and selection, the following key words were used: *Hippotherapy* and *Elderly*. Furthermore, the documents selected to be part of the sample had to meet a series of inclusion criteria (Table 1). The following computerized databases were used, which store the main scientific publications on any field of knowledge: *SCOPUS*, *WOS*, *SPORTDiscus*, *PubMed* and *Cochrane*.

Coding of the variables

The documents selected were classified, based on the following criteria: *Title*, *Author(s)*, *Year*, *Keywords*, *Database*, *Abstract*, *Type of study*, *Sample*, *Benefits and Quality* of the documents selected (Table 2).

Study recording procedure and data analysis

The procedure used for this study is similar to those found in the scientific literature^{4,24,25}. Good planning of the literature search is key to success²⁶, making it possible to draw relevant conclusions²⁴. All the documents selected for the study met the inclusion criteria established.

Table 1 Document inclusion and exclusion criteria.

No.	Inclusion criteria
1	Mention at least some of the characteristics of Hippotherapy for the elderly (minimum 20 words).
2	Select only scientific documents (articles from journals).
3	Full text or abstract available.
4	Written in Spanish, English or Portuguese.
Exclusion criteria	
5	Exclude those documents in which only the keywords entered in the databases are mentioned.
6	Exclude those articles based solely on mechanical horse-riding simulators.
7	Leave out documents that cannot be referenced.
8	Exclude articles that only refer to the elderly.

Table 2. Characteristics of the literature review study variables.

Variable	Description
Title	Title in English of selected article.
Author(s)	Scientific name of each author of selected document.
Year	Year of official publication of selected article.
Keywords	Keywords used in article.
Database	Data platform providing access to selected article.
Summary	Brief indication of the principal ideas and objective(s) of selected document.
Type of study	Classification of selected articles based on study type according to Montero & Leon (2007): Theoretical studies, Empirical studies with quantitative methodology & Qualitative empirical studies.
Sample	Set of individuals or data randomly chosen, which are considered to be representative of the group to which they belong and which are taken to study.
Benefits	Indication of the beneficial effects of Hippotherapy in the elderly.
Quality of the	Percentage relating to the quality of the documents documents selected by observers external to the investigation.

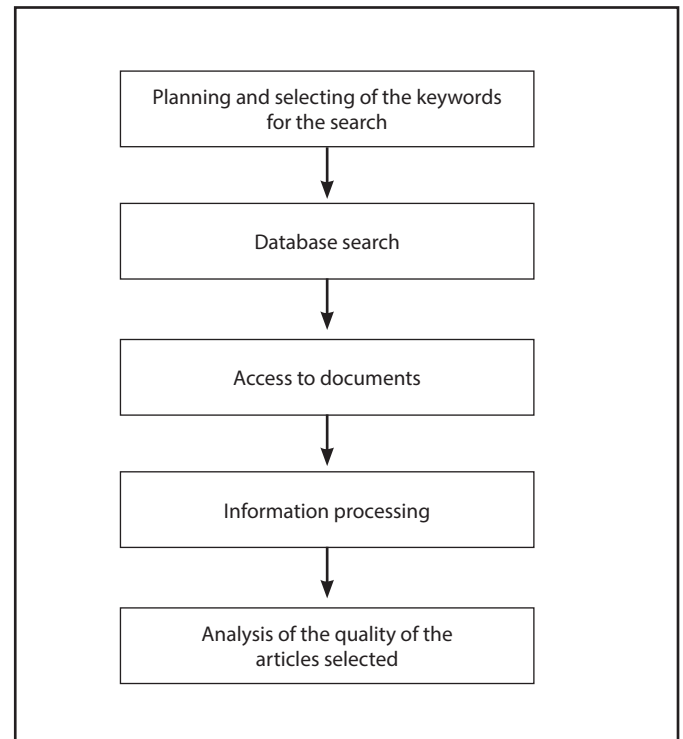
Figure 1. Flow diagram of the bibliographic search process.

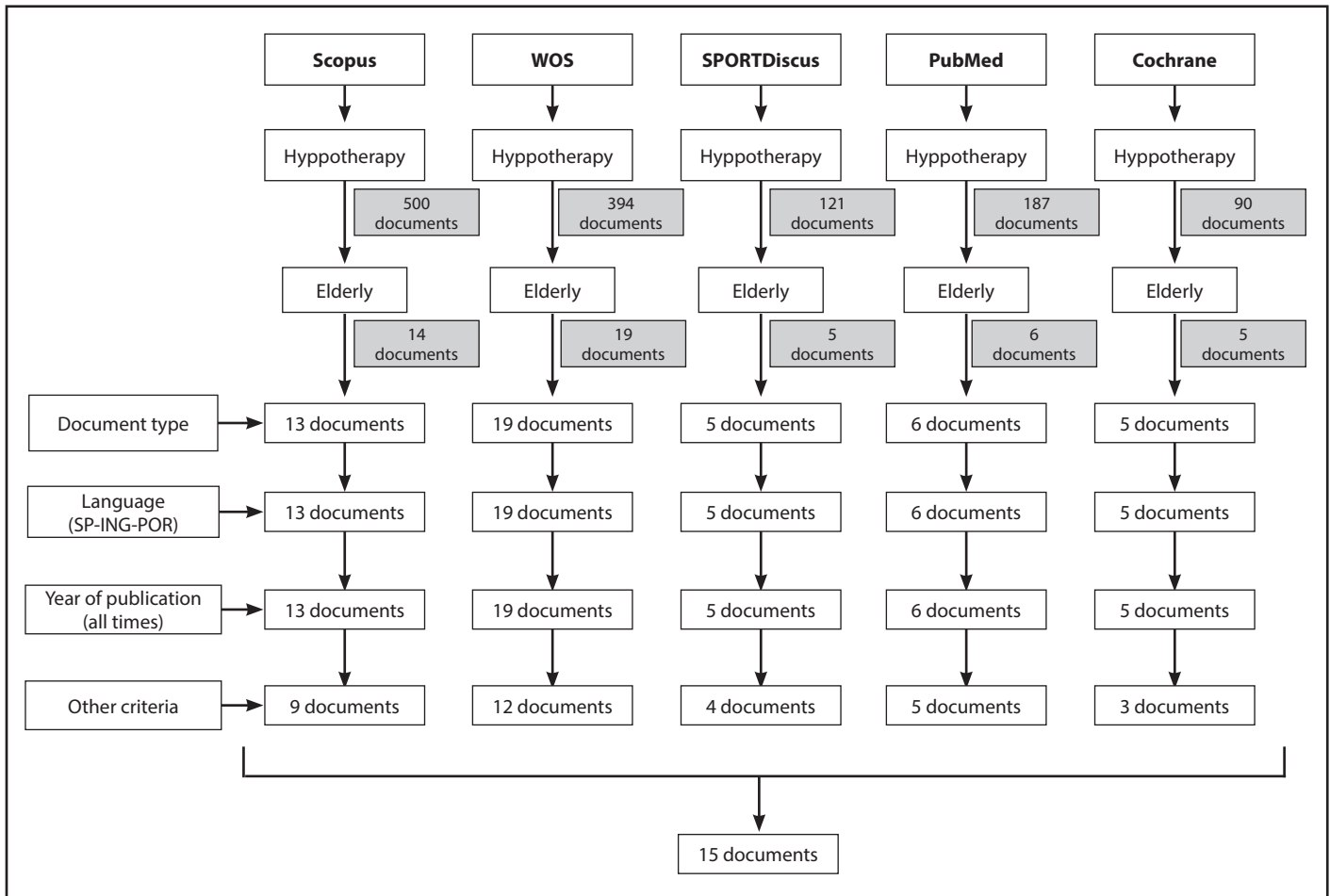
Figure 1 sets out the search process conducted for this work.

- *Phase 1 Planning and selecting of the keywords for the search.* For the selection of the key words, account was taken of the objectives of the literature review relating to the benefits of Hippotherapy for the elderly. In order to locate the highest number of related scientific documents (journal articles), a search was made using the keywords in English “Hippotherapy” and “Elderly”. The aforementioned inclusion criteria were established (Table 1). The same keywords, and the same order were used in all the databases consulted.
- *Phase 2 Database search.* Five bibliographic searches were made in the following computerized databases: SCOPUS, WOS, SPORTDiscus, PubMed and Cochrane. To do so, the same Boolean search procedure (And) was used in each database for the purpose of finding the greatest possible number of related documents. The final search phrase was: *Hippotherapy - And - Elderly*. The documents selected for the study met the inclusion criteria established. The document search structure in the different databases is shown in Figure 2. As keywords were progressively added in the search engine, the results decreased considerably. The document inclusion and exclusion criteria were subsequently applied.
- *Phase 3 Access to documents.* Some of the databases used for the search for references do not allow access to full-text documents. Therefore, in order to consult the greatest number of original full-text articles, the web portal of the electronic library of the University

of Extremadura was used, as well as different platforms and web search engines to contact the authors^{7,25}. The sample was reduced to 15 articles, which were reviewed in depth. The number of documents selected must not be too large given that the processing of the information could be contaminated by the researcher²⁷.

- *Phase 4 Processing of information.* For each article, an analysis was made of the *Title, Author(s), Year, Keywords, Database, Abstract, Study type, Sample, Benefits and Quality*. For this purpose, it is important to organise and categorize all the information obtained⁷. Furthermore, a summary of each document was made, by preparing a table with all the information that would allow for an optimal and efficient review. Likewise, a descriptive analysis was made of the following variables: *Year, Keywords and Databases* in the various articles in order to identify their relationship with the study topic, as conducted by the authors⁵. For those articles with no keywords, the investigators themselves determined a series of terms, based on the subject of the study. Finally, the main benefits of Hippotherapy for the elderly were drawn from the selected articles. Figure 3 shows the main keywords used in the selected journal articles. Furthermore, Figure 4 shows the number of articles selected based on the *Year of publication*, and Figure 5 shows the number of articles selected based on the *Database*. These statistical analyses provide the link with the objective of this study, and also make it possible to identify a larger amount of relevant information related to the documents selected.

Figure 2. Schematic of the documents found in the different databases.



– *Phase 5 Analysis of the quality of the articles selected.* For the analysis of the quality of each study, a quality questionnaire was prepared, similar to the one proposed by the authors²⁸. This questionnaire comprised 16 questions with either a Yes or No answer (Table 3). Furthermore, the evaluation process was conducted by 3 outside observers (holding a Degree in Physical Activity and Sport Sciences) and with a deep knowledge of the study subject (Table 4). The studies analysed were assessed according to purpose (Q1), bibliographical data/background (Q2), design (Q3), sample (Q4 and Q5), the use of informed consent (Q6), measurements and result (Q7 and Q8), method and description (Q9), the importance of the results (Q10), the methods of analysis (Q11), information on the practical importance (Q12), subject drop-outs (Q13), conclusions (Q14), practical implications (Q15) and the study limitations (Q16). The 16 document quality criteria were given a score on a binary scale (Yes=1/No=0). Each article was classified as (A) *Excellent methodological quality*, with a score > 75% (B) *Good methodological quality*, with a score from 51% to 75%, and (C) *Poor methodological quality*, with a score < 50%. For the review articles, those questions

that could not be answered by the methodology used, were assumed to be 1=Yes.

Results

The results are shown in the same order in which the bibliographic review was conducted. Table 5 shows the different articles and their main characteristics regarding the benefits of Hippotherapy in the elderly, based on the criteria defined in the method. Moreover, they are shown in chronological order, for ease of reading.

Discussion

This study updates the state of knowledge with regard to the benefits of Hippotherapy for the elderly, using methodological procedures that are similar to those existing in the scientific literature²³⁻²⁵, identifying and classifying the most relevant information. Furthermore, it serves as a basis for future reviews while also making it possible to draw relevant conclusions. On the other hand, it has made it possible to analyse the

Figure 3. Main keywords relating to the benefits of Hippotherapy in the elderly.

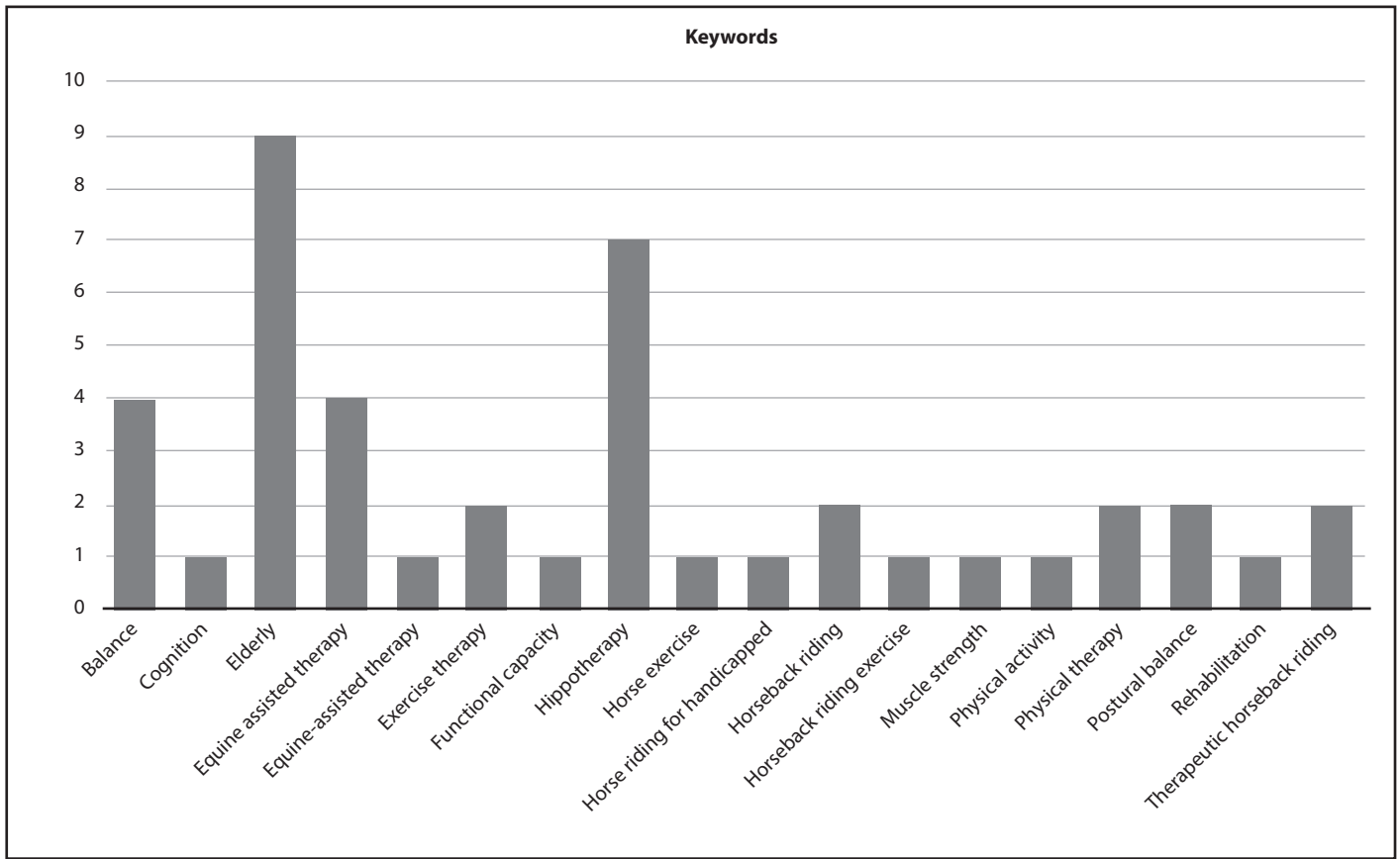


Figure 4. Number of documents selected based on the year of publication.

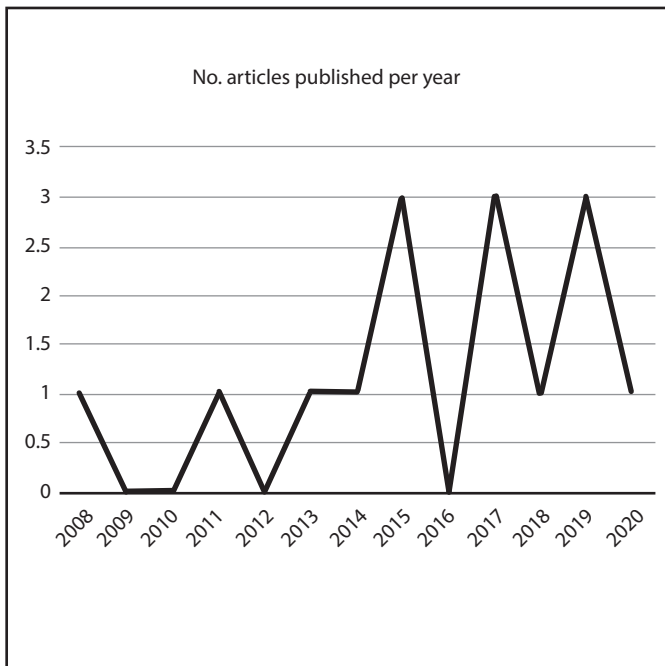


Figure 4. Number of documents selected based on the database.

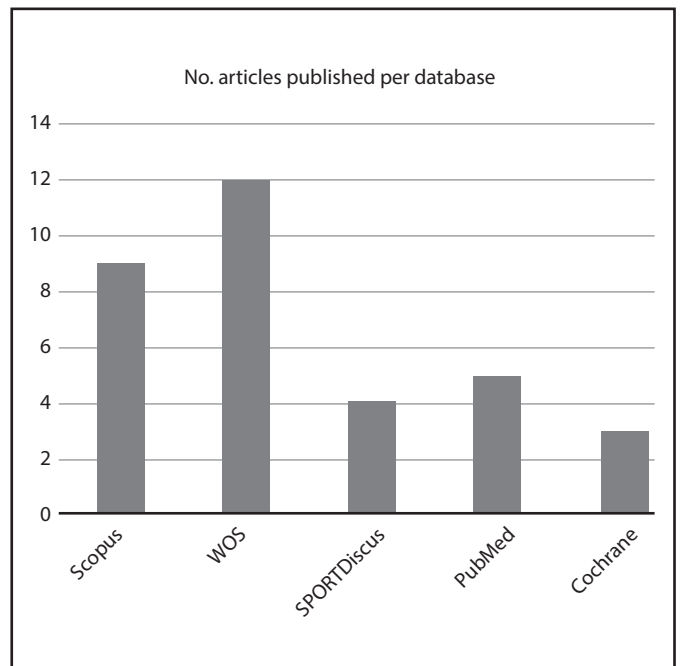


Table 3. Article quality criteria.

Q1	Was the purpose of the study clearly indicated?	1=Yes	0=No
Q2	Did the authors review the relevant background literature?	1=Yes	0=No
Q3	Was the design appropriate for the investigation question?	1=Yes	0=No
Q4	Was the sample described in detail?	1=Yes	0=No
Q5	Was the sample size accounted for?	1=Yes	0=No
Q6	Was informed consent obtained? (If not described, assume that this was not so)	1=Yes	0=No
Q7	Were the result measurements reliable? (If not described, assume that this was not so)	1=Yes	0=No
Q8	Were the result measurements valid? (If not described, assume that this was not so)	1=Yes	0=No
Q9	Was the method described in detail?	1=Yes	0=No
Q10	Were the results reported in terms of statistical significance?	1=Yes	0=No
Q11	Were the analysis methods approved?	1=Yes	0=No
Q12	Was the importance of the practice reported?	1=Yes	0=No
Q13	Was the drop-out rate reported?	1=Yes	0=No
Q14	Were the conclusions appropriate given the study methods?	1=Yes	0=No
Q15	Are there any implications for the practice given the results of the study?	1=Yes	0=No
Q16	Are the study limitations recognised and described by the authors?	1=Yes	0=No

Table 4. Article quality analysis

Documents	Observer 1	Observer 2	Observer 3	Mean	Quality
1	62.5	62.5	68.75	64.583	C
2	81.25	87.5	75	81.250	A
3	75	75	87.5	79.167	A
4	87.5	87.5	87.5	87.500	A
5	75	81.25	81.25	79.167	A
6	81.25	75	75	77.083	A
7	100	100	100	100,000	A
8	100	100	100	100,000	A
9	100	100	100	100,000	A
10	81,25	81,25	81.25	81,250	A
11	87,5	87,5	87.5	87,500	A
12	93,75	87,5	87.5	89,583	A
13	87,5	87,5	87.5	87,500	A
14	87,5	93,75	93.75	91,667	A
15	87,5	87,5	87.5	87,500	A

A: Excellent methodological quality; B: Good methodological quality; C: Poor methodological quality.

main components of Hippotherapy and to determine their benefits, identifying how the sessions should be addressed in order to achieve a positive effect on the elderly. For this purpose, different techniques to access the information were used, preparing a bibliographic review of the documents selected. Following the review process, a wide variety of study Types were found, ranging from *theoretical* to *quantitative*. All the studies agree that the main problems caused by ageing are loss of balance, strength and muscle mass, as well as the risk of falls. On the other hand, account should be taken of the individual characteristics of each participant, given that each person is different and will have

a different response, also considering the “active and healthy ageing” approach²⁹, which considers that each subject will have a different rate of senescence.

The *theoretical studies* conducted^{13,30,31} concluded that Hippotherapy or therapeutic horse-riding is beneficial to the elderly. All underscore improved balance and postural control, with the subsequent decrease in the risk of falls. However, a more recent review³² suggests that the current studies on Equine-Assisted Therapies (hereinafter EAT) are methodologically weak, poorly designed, have a small sample and many of these studies lack control groups and details on the intervention

Table 5. Principal investigations and characteristics regarding the benefits of Hippotherapy in the elderly.

Title	Author	Year	Keywords	B	Abstract	Type	Sample	Benefits	Quality
The use of hippotherapy as therapeutic resource to improve the static balance in elderly individuals	Toigo, Júnior, Pinto & Ávila	2008	Physical Therapy Musculoskeletal, Equilibrium, Exercise movement, Epidemiology experimental, Women, Middle aged, Aged	WOS	Hippotherapy as a means to improve static balance in the elderly. Experimental study with a pre- and post-test Healthy, elderly individuals experience balance alterations, Hippotherapy serves to improve balance.	Quantitative study	10 women aged from 60 to 74 years	Improvements in static balance and reduction in risk of falls.	64,583
Effect of equine-assisted therapy on the postural balance of the elderly	Araujo, Silva, Costa, Pereira & Safons	2011	Equine-assisted therapy, Postural balance, Elderly, Physical therapy, Rehabilitation	WOS/ Scopus/ PubMed/ SPORT Discus	Determine whether Hippotherapy produces alterations in the balance of the elderly. Old age tends to normalise stabilometric measurements, however horse assisted interventions lead to a significant improvement in balance as well as a reduction in the risk of falls.	Quantitative study	17 elderly individuals	Reduces the risks of falls in the elderly.	81,250
Effects of hippotherapy on mobility, strength and balance in elderly	Araújo, De Oliveira, Martins, De Moura-Pereira, Copetti & Safons	2013	Hippotherapy, Muscle strength, Postural balance, Gait, Elderly.	WOS/ Scopus/ PubMed/ Cochrane	Evaluates the chronic effects of Hippotherapy on functional mobility, muscle strength and balance in elderly individuals.	Quantitative study	28 individuals aged from 60 to 84 years, men and women	Improves the strength of the lower limbs and balance in the elderly.	79,167
The Effects of Hippotherapy on Elderly Persons' Static Balance and Gait	Kim & Lee	2014	Elderly, Balance, Hippotherapy	WOS/ Scopus/ PubMed/ Cochrane	Examines the effects of Hippotherapy on the static balance and gait of the elderly.	Quantitative study	30 elderly individuals	Improves the static and dynamic balance of the elderly.	87,500
Effects of horseback riding exercise therapy on hormone levels in elderly persons	Sung-Hyoun, Jin-Woo, Seon-Rye & Byung-Jun	2015	Hormone, Exercise therapy, Horseback riding	WOS	Determines the effects of horse-riding on the normal hormone levels of the elderly. Horse therapy produces a significant increase in serotonin and cortisol	Quantitative study	20 elderly individuals	Increased serotonin and cortisol levels.	79,167
Effects of horseback riding exercise therapy on background electroencephalograms of elderly people	Kim, Cho, Kim, Lee, Brienen & Cho	2015	Exercise therapy, Electroencephalogram, Horseback riding	WOS	Analyses the effect of horse-riding therapy on the electroencephalograms of the elderly. It suggests that horse-riding therapy improves it.	Quantitative study	20 elderly individuals	The alpha power index increased significantly after horse riding, suggesting that the exercise improved the electroencephalogram.	77,083

(keep going)

Title	Author	Year	Keywords	B	Abstract	Type	Sample	Benefits	Quality
Comparative Effects of Horse Exercise Versus Traditional Exercise Programs on Gait, Muscle Strength, and Body Balance in Healthy Older Adults	Aranda-García, Iricibar, Planas, Prat-Subirana, & Angulo-Barroso	2015	Elderly, Physical Activity, Horse Exercise, Follow-Up Study, Rural Community	WOS	Evaluates and compares the effect of 2 physical exercise programs, one traditional and the other on horseback, with regard to the physical and functional capacity of healthy elderly individuals. Horse exercises could be an alternative to traditional physical exercises for the elderly.	Quantitative study	38 healthy individuals aged over 60 years (TE= 17, HE=10, CG=11)	Horse exercise is a viable activity to maintain or improve the physical functions of the elderly. It leads to improvements in gait speed, maximum isometric force of the knee extensor muscles.	100,000
Equine-assisted therapy intervention studies targeting physical symptoms in adults: A systematic review	White-Lewis, Russell, Johnson, Cheng & McClain	2017	Equine assisted therapy, Therapeutic horse riding, Therapeutic horseback riding, Hippotherapy, Equine psychotherapy, Equine facilitated therapy, Horse riding for handicapped, Equus.	Scopus	Systematic review analyzing the evidence and quality of Hippotherapy studies.	Theoretical study		Improved balance, plasticity, muscle strength, gait and cadence as well as quality of life. Improvements at a biological, psychological and social level.	100,000
Therapeutic Effects of Horseback Riding Interventions: A Systematic Review and Meta-analysis	Stergiou, Tzoufi, Ntzani, Varvarousis, Beris & Ploumis	2017	Therapeutic Horseback Riding, Hippotherapy, Cerebral Palsy, Multiple Sclerosis, Neuromuscular Disease, Elderly, Stroke, Neuro-motor; Physical Disabilities.	Scopus/ SPORT Discus	Studies the possible positive effects of EAT, both at a physical and mental level. The EAT are feasible interventions for patients with balance, gait and psychomotor problems.	Theoretical study		Improves balance, gait and psychomotor disorders.	100,000
Effects of horseback riding exercise on the relative alpha power spectrum in the elderly	Sung-Hyoun Cho	2017	Horseback riding exercise Relative a-power spectrum Elderly Slow alpha power Fast alpha power	Scopus/ WOS/ Cochrane	Identification of the effects of horse-riding and the mechanical simulator on the alpha power spectrum in the elderly. Both interventions have a positive effect on the psychological stability of the elderly.	Quantitative study	31 individuals aged over 65 years (CG=15; SG=16)	Improvements in the high power electroencephalogram, activation of all areas of the electroencephalogram, improving concentration and rest. Benefits to psychological stability.	81,250
Effect of hippotherapy on older balance: a systematic review with methanalysis	Araújo, Martins, Blasczyk, Feng, Oliveira, Copetti & Safons	2018	Hippotherapy, Elderly, Balance	WOS/ SPORT Discus	Studies the existing signs of Hippotherapy in relation to the balance of the elderly, and concludes that it has a significant effect on improving the postural balance of the elderly.	Theoretical study		Improvement in the postural balance of the elderly.	87,500

(keep going)

Title	Author	Year	Keywords	B	Abstract	Type	Sample	Benefits	Quality
Impact of hippotherapy for balance improvement and flexibility in elderly people	Diniz, De Mello, Ribeiro, Lage, Júnior, Ferreira, Da Fonseca, Rosa, Teixeira, & Espindula	2019	Balance, Flexibility, Elderly, Horse-assisted therapy.	WOS/ Scopus/ PubMed/ SPORT Discus	Information on the impact of Hippotherapy on the elderly. Ageing leads to a decrease in functional ability, strength, balance, flexibility, agility and coordination, due to neurological and muscular changes. Hippotherapy improves the functional mobility, dynamic balance and flexibility of the elderly.	Quantitative study	30 elderly individuals	Improves the functional mobility, dynamic balance and flexibility of the elderly.	89,583
An umbrella review of the evidence for equine-assisted interventions	Stern & Chur-Hansen.	2019	Animal-assisted interventions; Equine-assisted interventions; Hippotherapy; Systematic reviews; Umbrella review.	WOS	Review of current EAT documentation. The evidence from the EAT may be incorrect. The basis for the current evidence is methodologically weak. Therefore, at present, therapeutic horse-riding interventions cannot be recommended as the best practice. Higher quality studies are necessary.	Theoretical study		There are a number of benefits. However, there is a lack of scientific evidence.	87,500
An Exploration of Equine-Assisted Therapy to Improve Balance, Functional Capacity, and Cognition in Older Adults with Alzheimer Disease	Borges, Martins, Freitas, Camargos, Mota & Safons	2019	Alzheimer disease, balance, cognition, equineassisted therapy, unctional capacity	Scopus	Studies the benefits of EAT in elderly individuals with Alzheimer's, given that physical and cognitive aspects are involved. The objectives are to describe the effects of the EAT on the balance, functional capacity and cognitive level of elderly individuals diagnosed with Alzheimer's. The results show significant improvements in the Wilcoxon test.	Quantitative study	9 elderly individuals (79.7 ± 7.8 years) with Alzheimer's	Improvements in the balance and functional capacity. There is no cognitive decline.	91,667
Electromyographic analysis of stomatognathic muscles in elderly after hippotherapy	De Mello Regalo, Diniz, Lage, Ribeiro, Bevilacqua Junior et al.,	2020	Hippotherapy, elderly, Electromyographic analysis, stomatognathic muscles.	WOS/ Scopus/ PubMed	Uses electromyography to evaluate the muscles of the stomatognathic system (masseter and temporalis) in the elderly before and after participation in hippotherapy. Hippotherapy promotes a reduction in the myoelectric activity of the mastication muscles in the elderly.	Quantitative study	17 elderly individuals (66.5 ± 7 years)	Reduction in the myoelectric activity of the muscles involved in mastication. (In healthy subjects there is less fibre recruitment to perform the same mastication process, compared to persons with morpho-functional changes that generate stress and fatigue).	87,500

A: Year of publication; B: Database; EAT: Equine Assisted Therapies.

made. It would therefore be recommendable to conduct longitudinal studies for the purpose of checking the durability of the benefits of this technique in the elderly.

On the other hand, the *Quantitative Studies* included in this review have a small sample, the largest one being the work by³³, with 38 subjects, and which moreover had a control group, while the smallest sample appears in a study conducted by³⁴, which only had a sample of 9 elderly persons with Alzheimer's. Most of the *Quantitative Studies* included in this review^{12,33,35} focus on the beneficial effects of Hippotherapy with regard to balance, gait and the risk of falling in the elderly. It would therefore be recommendable to look at other benefits and to use other data recording tools for the investigations, such as inertial devices. These tools make it possible to quantify the internal and external load placed on users.

The studies conducted by^{36,37}, based on a sample of 20 participants, of which 10 were in the control group and 10 in the experimental group, and by³⁸, with a sample of 31 participants, 15 in the control group and 16 in the experimental group, both detail the procedure used during equestrian therapies for the purpose of identifying neurological and hormonal changes. Studies^{37,39} conclude that the practice of therapeutic riding increases the alpha wave index and the electromagnetic oscillations which are indicative of stability and relaxation, promoting improved brain function and, therefore, useful in the prevention of ageing-associated neurodegenerative diseases. Furthermore, the study by³⁸ analyses the effects of therapeutic riding on hormone levels, which promote psychological benefits by reducing depression levels, stress and behavioural problems. This exercises a positive effect on frame of mind, sleep and agitation due to the increased levels of serotonin and cortisol. Therefore, the use of different animals to interact with the elderly for therapeutic purposes is fundamental in order to study the potential physical, psychological and social benefits.

Due to the usefulness of EAT at a physical and cognitive level, the study conducted by³⁴ focuses on the benefits of Hippotherapy in elderly persons with Alzheimer's, being the only study in our analysis to have a sample of individuals with a chronic degenerative disease. It shows the benefits of EAT for this group. Therefore, there is a need for Physical Activity and Sport Science investigators to conduct studies relating to Hippotherapy as a beneficial alternative to physical activity for different users, with and without a disability or previous pathologies. With regard to the study conducted by⁴⁰, this was the only work analysed to use electromyography to evaluate the activation of the stomatognathic muscles (masseter and temporalis) in the elderly before and after participation in Hippotherapy sessions. These muscles, involved in mastication, increase their tension and activation (muscle fibre recruitment) with age-related morphofunctional changes, generating stress and fatigue. The study demonstrates that the Hippotherapy session leads to a reduction in the myoelectric activation of these muscles, which is beneficial. This type of work makes it clear that there is still a long way to go with regard to Hippotherapy-related investigations.

With regard to the experimental study interventions, the sessions had an approximate duration of 30 minutes^{12,30,36}. However, in other Hippotherapy studies related to persons with cerebral palsy, the sessions were conducted once a week and with a duration of 45 minutes per session⁷. It would therefore be recommendable to conduct in-depth studies to compare the benefits achieved based on the duration of the sessions and their maintenance over time. Finally, there is a need to conduct further investigations on the benefits of Hippotherapy and therapeutic riding in the elderly, with larger samples, greater detail on the interventions performed, over longer periods of time and which contain quantifiable and contrastable evaluations, for the purpose of providing greater evidence that will make it possible to recognise Hippotherapy as an effective treatment.

Conclusions

Following this review of the literature, it can be concluded that Equine Assisted Therapies and Hippotherapy have beneficial therapeutic effects for the elderly if performed progressively and correctly. It is essential for these therapies to be performed by a suitably trained professional, multi-disciplinary team.

Hippotherapy interventions improve static and dynamic balance, postural balance, functional mobility, flexibility, muscle strength, gait, cadence and reduce plasticity. These beneficial effects lead to a lower risk of falls, improving the quality of life of the elderly. Furthermore, they lead to enhanced brain function and increased hormone levels, such as serotonin and cortisol, providing psychological benefits, reducing stress levels, depression and behavioural problems, also improving the quality of sleep and exerting a positive influence on the frame of mind.

Despite the fact that there are few EAT studies and that these are methodologically weak, this type of therapy is recommended in order to achieve biological, psychological and biological improvements.

Finally, the main limitation of the quantitative studies is the small sample size, lack of a control group and no follow-up of the participants, as well as the short duration of the sessions, making it impossible to generalise the results. In another respect, it would be of interest to have in-depth information on the daily habits of the subjects, as this could affect the results of the investigations.

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Conflict of interests

Work conducted within the Group for the Optimisation of Sport Performance and Training (GOERD) of the Faculty of Sport Sciences of

the University of Extremadura. All authors contributed to the preparation of the manuscript and we certify that it has not been published or being considered for publication in another journal.

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