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CRIANÇAS COM SÍNDROME DE DOWN E TERAPIA ASSISTIDA POR EQUINOS: UMA REVISÃO SISTEMÁTICA

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Resumo: A Terapia Assistida por Equinos (TAE) é um método terapêutico e educacional, que utiliza o cavalo dentro de uma abordagem interdisciplinar. O objetivo desta revisão sistemática da literatura foi analisar a produção bibliográfica relacionada a Terapia Assistida por Equinos (TAE) como ferramenta no desenvolvimento global da criança com Síndrome de Down (SD). Métodos: Os critérios de inclusão foram: ensaios clínicos randomizados; população diagnosticada com SD e idade ≥ 13 anos; publicados no período de 2015 a 2021; indexados nos periódicos qualis entre A1 e B3, nas seguintes bases eletrônicas de dados: National Library of Medicine (PUBMED), Scientific Electronic Library Online (SciELO) e Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS). Resultados: foram encontrados 18 artigos, dos quais 8 atenderam ao objetivo e aos critérios propostos no estudo. Conclusão: Pode-se verificar que a TAE mostra-se como uma ferramenta eficaz e importante, portanto, contribui para o progresso no desenvolvimento global e evolução nas habilidades funcionais de crianças com SD.

Palavras-chave: Terapia Assistida por Equinos; Síndrome de Down; Fisioterapia; Reabilitação.

Afiliação

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CHILDREN WITH DOWN SYNDROME AND EQUINE - ASSISTED THERAPY: A SYSTEMATIC REVIEW

Abstract: Equine Assisted Therapy (EAT) is a therapeutic and educational method that uses the horse within an interdisciplinary approach. The objective of this study was to analyze the publications on Equine Assisted Therapy (EAT) as a tool in the global development of children with Down Syndrome (DS). Methods: The criteria were: randomized clinical trials; population diagnosed with DS and age ≥ 13 years old; published from 2015 to 2021; indexed by Qualis between A1 and B3, in the following electronic databases: National Library of Medicine (PUBMED), Scientific Electronic Library Online (SciELO) and Latin American and Caribbean Literature in Health Sciences (LILACS). Results: 18 articles were found, of which 8 met the objective and criteria proposed in the study. Conclusion: It can be seen that EAT proves to be an effective and important tool; therefore, it contributes to the progress in the global development and improvement of the motor functions of children with DS.

Key words: Equine Assisted Therapy; Down Syndrome; Physical Therapy Specialty; Rehabilitation Services.

Introduction

Child development is topic of interest of several study areas, with various theories and discussions on the matter. The construction of scientific knowledge in the field that works with people with disabilities has greatly progressed, contributing with new ways of working to further improve these people's development. In the present study, equine-assisted therapy (EAT) is shown as an intervention tool in the global development of children with Down Syndrome (DS).

Down Syndrome is a genetic disorder in chromosome 21 resulting in impairment of motor and cognitive functions, and thus leading to abnormalities in the global development of the child¹. There are three types of DS: trisomy 21, mosaicism and translocation¹. Children with Down syndrome typically present delays in the different areas of development. These delays; however, may vary from one child to another according to their individualities.²

Children with DS often present a characteristic phenotype that includes short neck, hands, feet and short stature, as well as ligament laxity, atlantoaxial instability, hypotonia and consequent decreased muscle strength and proprioceptive alterations³. As secondary consequences, they may present: congenital heart defects, respiratory complications and gastrointestinal defects⁴. Policarpo and Santos⁴ report that people with DS present impairment of respiratory muscles.

A rehabilitation tool which has gained prominence is Equine Assisted Therapy (EAT), terminology established by Wood et al.⁵ as a concise abbreviation to refer to a wide range of services which differ from one another but have the horse as a common thread.

During EAT, the horse's three-dimensional movement is similar to human walking⁷ and requires constant postural changes from the rider, thus providing proprioceptive, tactile, visual and vestibular inputs⁸. However, animal therapy for children with DS requires medical monitoring capable of certifying their ability to withstand all the mechanical and sensory stimuli during the procedure. Children with DS that have atlantoaxial instability demand special attention, due to the possible occurrence of dislocation or subluxation of vertebrae in therapy⁹.

Having in mind that EAT is a therapeutic and educational method that stimulates the participant globally, the dynamics of this practice contributes to motor, emotional and cognitive stimulation, whether the participant is mounted or unmounted⁶. Therefore, the objective of this systematic review was to analyze the publications on EAT and children with DS.

Methods

This study was carried out according to the methodological guidelines for the elaboration of a systematic review¹⁰ as described in PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)¹¹. The research question started from the hypothesis that EAT is an auxiliary tool in the global development of children. Therefore, it is necessary to verify if it helps in the global development of children with DS.

Search Strategy

A systematic search for articles was carried out in three databases: National Library of Medicine (PUBMED), Scientific Electronic Library Online (SciELO) and Latin American and Caribbean Literature in Health Sciences (LILACS), using the relevant Entry Term and Boolean Operator (AND).

For the computerized search of scientific publications, the following Health Sciences Descriptors (DeCS) and their combinations in Portuguese and English were used: hippotherapy, Down Syndrome and rehabilitation, and the synonym pointed out by the DeCS which is “Equine-Assisted Therapy”, with the purpose of expanding the searches for articles.

Study Selection Criteria

The selection of studies was carried out simultaneously and independently by two researchers, and should they have any doubts, a third researcher was consulted. The research was followed adequate methodological rigor, comprising the following phases: identification (recognition of the subject relevant to the theme), location (search in libraries or online sources), compilation (systematic gathering of the information found), filing (data transcription) and critical analysis (critical interpretation of the bibliographic material found)¹².

The study inclusion criteria were: randomized clinical trials, population diagnosed with DS and age ≥ 13 years old, published between 2015 and 2021, indexed by Qualis between A1 and B3, publications in Portuguese and English; exclusion of literature reviews and commentaries or studies that did not analyze the intervention as a developmental tool. Articles that were repeated in two or more databases were considered as just one.

Data Extraction

After selecting the studies, the abstracts were read and an in-depth analysis was carried out on those that addressed EAT as an intervention in the global development of children with DS. For this analysis the following sequence was prepared: author and year of publication,

study objectives, intervention, sample, results and the PEDro Scale score, which is based on a Delphi list. This scale assesses the methodological quality of the studies, with the observation of internal validity and the existence of sufficient statistical information for their results to be interpreted¹³. The scale was structured with 11 criteria. Criterion 1 does not score; therefore, the final score varies from 0 to 10 points.¹³

Results

From the descriptors and Boolean operator mentioned, 18 publications were found. After checking the duplicate references, 15 remained. One of the articles had a population composed of adults, 2 did not use the EAT as a developmental intervention tool, 3 were literature reviews or commentaries, and 1 was not indexed in Qualis subject area of the study. Thus, 8 articles met the criteria established and were included in this study. They are shown in Figure 1.

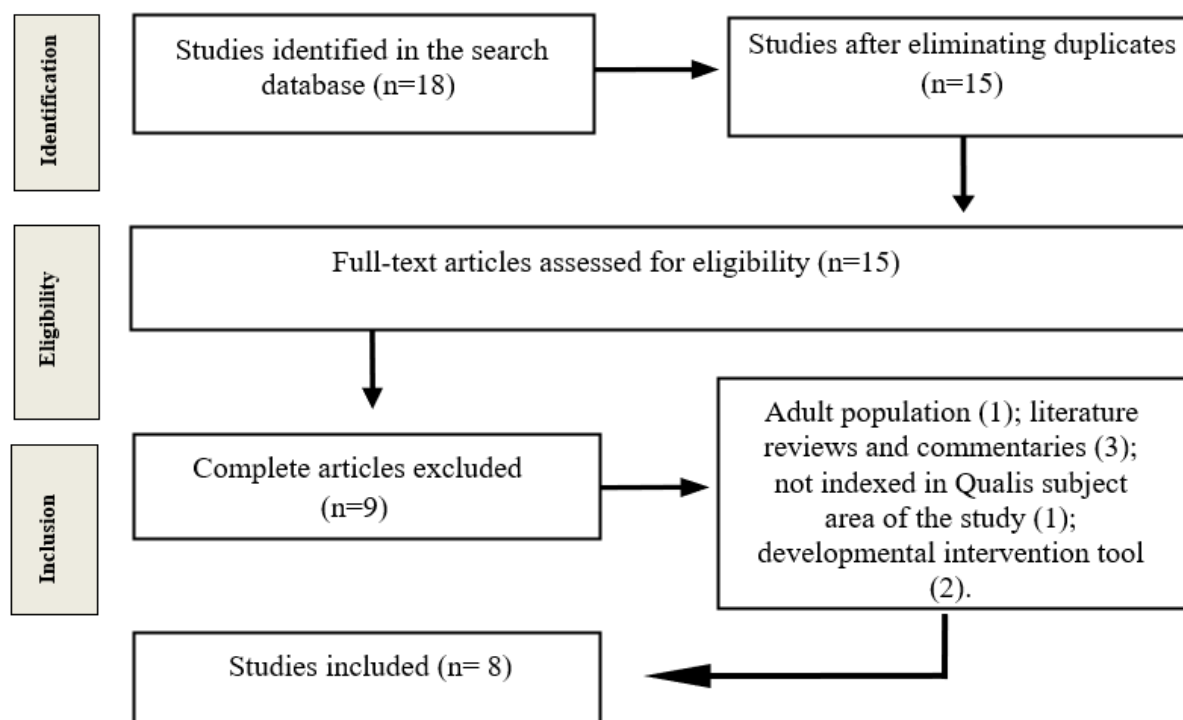


Figure 1 – Selection flowchart for inclusion and exclusion of reviewed articles.

The information contained in the studies was synthesized. Out of the 8 articles included, only 2 was published in Portuguese.

The number of participants ranged from 5 to 41. All studies were carried out with participants under 13 years old, aged between 3 and 13, of which 2 were carried out with a male

population and 4 studies with both sexes.

Regarding the duration of the interventions, it was observed that EAT was performed from 8 to 27 weeks, with an average of 16.7 sessions, and the frequency varied from 1 to 2 sessions per week.

Regarding the methodological quality of the articles, the average score on the PEDro scale was 5.67 points, indicating good methodological quality for the studies. These results are presented in Table 1.

Table 1 – Description of the selected studies on equine-assisted therapy (EAT) and children with Down Syndrome

Table 1 – Description of the selected studies on equine-assisted therapy (EAT) and children with Down Syndrome (DS)

Author	Title	Objective	Intervention/ Session	Sample/Age	Results found	PEDro score
Moriello, Terpstra and Earl ¹⁴	Outcomes following physical therapy incorporating hippotherapy on neuromotor function and bladder control in children with Down syndrome: A case series	Document gross motor function, gait parameters and bladder control	- Weekly - 30 minutes - 8 sessions	- 4 children between the age of three and five - 3 girls 1 boy	Progression in gait parameters. However, the results were inconsistent for bladder control	5 points
Jackson-Mandonado ¹⁵	Hippotherapy and the Communicative Abilities of Children with Down Syndrome: A Preliminary Study.	Demonstrate the effects of EAT on the communicative skills of a group of children with DS	- Biweekly - 30 minutes - 12 sessions	9 children between the age of 4 and 7 - 4 girls 5 boys	Improvement in speech production and length of utterance	5 points
Espindula et al. ¹⁶	Effects of hippotherapy on posture in individuals with Down Syndrome	Evaluate the posture of children with DS post EAT	- Weekly - 30 minutes. - 27 sessions	- 5 children (boys) with an average age of 12.6 years old.	Improvement in shoulders, head and lower limbs alignment, as well as a decrease in kyphosis and head protrusion	5 points
Ribeiro et al. ¹⁷	Postural assessment pre and post EAT in individuals with Down syndrome.	Assess postural changes in participants with DS	- 10 first sessions (1x week); Last 10 sessions (2x week) - 30 minutes. - 20 sessions	- 5 children (boys) with an average age of 12.6 years old	Decreased pelvic anteversion, and knee hyperextension, with improvement in lower limb alignment	5 points
Costa et al. ¹⁸	Effect of hippotherapy in the global motor coordination in individuals with Down Syndrome	Verify the effect of EAT on the global motor coordination of children with DS	- Minimum of 12 weeks - 2 weekly sessions	- 41 children - 20 participants (11 boys and 9 girls) and 21 non-participants (12 boys and 9 girls), between the ages of 7 and 13	Improvement in global motor coordination in children with DS	7 points
Costa et al. ¹⁹	Hippotherapy and respiratory	Analyze the	- Minimum of 12	- 41 children - 20	Increase in inspiratory	7 points

	muscle strength in children and adolescents with Down syndrome	respiratory muscle strength of children with DS.	weeks - 2 weekly sessions	participants (11 boys and 9 girls) and 21 non-participants (12 boys and 9 girls), between the ages of 7 and 13	and expiratory muscle strength in participants with DS	
Espindula et al. ²⁰	Evaluation of muscle using electromyography in patients with Down Syndrome undergoing equine-assisted therapy.	Investigate the effects of equine-assisted therapy on muscle activation of spinal and abdominal regions of patients with Down syndrome.	- 27 sessions - 30 minutes	- 11 children divided between the control group and children with Down Syndrome.	Around the 10th session muscle activation stabilized, with the need for greater time than 30 minutes sessions for children with Down Syndrome.	5 points
Ribeiro et al. ²¹	Electromyographic evaluation of the lower limbs of patients with Down syndrome in hippotherapy	Evaluate the motor behavior related to the control and the improvement of muscle activation in participants with DS.	The evaluations were performed on the 1st and 10th sessions (once a week), and after 2 months interval without treatment, they were performed on the 1st and 10th sessions (twice a week).	- 10 children divided in two groups: control and Down Syndrome.	The activation of the muscles of the lower limb increased with the passing of sessions, regardless the weekly frequency of attendance. The participants with DS presented satisfactory changes in muscle activation pattern.	5 points

*Prepared by the authors.

Discussion

After analyzing the publications from the last seven years on EAT and DS, it was possible to verify the evolution of EAT strategies, as well as the dimension of the results found, with several benefits for children with DS.

Moriello, Terpstra and Earl¹⁴ evaluated 4 children with DS pre and post EAT sessions. The authors¹⁴ found improvements in walking, running and jumping. However, they did not find evolution in the standing position. Through *feedback* provided by the mothers, all participants showed some improvement in balance, coordination, body alignment and social interaction. The results; however, were inconsistent for bladder control.

Regarding bladder control¹⁴, it is noteworthy that the *feedback* reported by the mothers was as follows: the first mother reported “my son is doing it much better than he was”; two mothers reported “my son is doing it better than before” and one mother reported “my son is doing the same”. When analyzing the study by Moriello, Terpstra and Earl¹⁴, we concluded that eight sessions may not have been enough to cause more effective changes in bladder control in children with DS.

Espindula et al.²⁰ on a study to evaluate the muscle activation of spinal and abdominal regions of participants with Down Syndrome found results regarding the muscle activation of these patients after a 30-minute EAT session and stated that 15 to 25 minutes of riding, generate approximately about 110 postural changes and 3000 steps, as a result of the repetitions from the horse's movement in each session, making it ideal for muscular changes.

Eventually, with increased practice and experience in a given task, an evolution in performance and development of motor learning and autonomy skills is achieved, resulting from the concepts of neural plasticity^{21,22}. This corroborates the data presented by Doralp²³, reporting that children with DS need varied EAT practice activities, as each body responds differently.

During EAT, the participant receives different muscle stimuli simultaneously and globally, and thus improves the orthostatic positioning of the trunk and enhances body awareness.⁸ It is extremely important for the child with DS the repetition of movements in each session, as well as between sessions, to strengthen the relationships between the different systems involved in therapy²³. According to Ribeiro et al.²¹ a reassuring

environment that offers satisfaction and is favorable to the development of the activity helps the motor performance of children with DS.

Ribeiro et al.¹⁷ found progression of the static balance in children with DS after EAT, being observed through postural changes in the lower limbs (LL). Participants showed decreased pelvic anteversion, patellar alignment and decreased LL hyperextension. In the study, the participants rode on the blanket, feet outside the stirrup and with the horse walking. Ribeiro et al.²⁵ emphasize that riding on the blanket with the feet outside the stirrup provides stimuli capable of eliciting significantly greater muscle activation in these muscle groups. This was verified through electromyography data found in their study. We believe that this type of material can be a differentiating factor for lower limbs interventions.

In their study, Espindula et al.¹⁶ used the same riding material (blanket), and the participants' feet outside the stirrups and also found positive changes in the postural alignment between the right and left sides of the participants' body, with progression in the positioning between the right and left manubrium, which suggests a decrease and evolution of thoracic kyphosis in the children evaluated¹⁶. It is important to emphasize the choice of material used and the positioning of the participants, as these can be fundamental for postural evolution. We can thus perceive the importance of the material used, as well as the variation of the participants' positioning on horseback. Espindula et al.²⁰ point out that even with the horse in a stationary position at the beginning and at the end of the sessions, the muscles are still stimulated. This is because the horse does not stop moving, since it alternates supporting limbs and moves its head, which must be used in EAT interventions.

In EAT, Espindula et al.²⁰ demonstrated that when riding, the region of the spine most stimulated in children with DS is the cervical region. Consequently, this region becomes more susceptible to the horse's movements and Matos⁹ highlights that special consideration should be given due to the risks that may occur. Therefore, we emphasize the importance of this information when considering that children with DS are hypotonic and have vertebrae instability.

In a study concerning the global motor coordination of children with DS, participants and non-participants of EAT, Costa et al.¹⁸ assessed coordination using four tasks: balance on beams, single-lever jump, side-jump and transfer on platform. In the comparison between the groups, it was observed that the children who practiced EAT showed progress in global coordination, with a significant difference mainly in balance on beams, single-

lever jump and side-jump. From these results we can assess the relevance of the data for coordination, as the evolution of these motor skills are fundamental for the global motor development of children with DS.

In the Jackson-Maldonado study¹⁵, the author analyzed the effect of EAT on the communication skills of children with DS. The children underwent conventional speech-language therapy and EAT. The results showed an increase in vocabulary and a greater extension of the utterance, with an effect on the expressive language of children with DS after EAT. Ramos and Nabeiro²⁶ state that the environment where EAT sessions are conducted leads to the child's sense of well-being and can be an indication of the great importance of the practice. When analyzing this information, we can observe that the outdoor environment brings a wealth of stimuli and greater dynamics to the therapies. Thus, EAT can use the environment to verbalize and expand the language of children with DS.

It is possible to find in the literature other studies that corroborate the study by Jackson-Maldonado¹⁵, which strengthens the evidence of the efficiency of this therapeutic method. Doralp²³ for example describes in his study that this therapeutic method requires the interaction of the somatosensory and visual systems. This data, from our point of view, may favor the motor and linguistic development of children with DS.

Regarding the cardiorespiratory function, Costa et al.¹⁹ analyzed the respiratory muscle strength of patients with DS, participants and non-participants of EAT. The authors evaluated the maximum inspiratory and expiratory pressures of the volunteers. All EAT participants showed changes in the values of the variables evaluated, with an increase in inspiratory and expiratory muscle strength, thus demonstrating that EAT can influence the respiratory muscle strength of participants with DS. We believe that these results are considerable, as they provide a form of therapy for a key aspect of children with DS, which is the issue of breathing pattern. Policarpo and Santos⁶ report that, as a consequence, the recurrence of possible respiratory diseases triggered by the syndrome can be avoided.

Based on the results of this review, we emphasize that the articles presented adequate methodologies. The number of sessions presented in the studies was diverse, these data become interesting because they present studies with a minimum of 8 sessions¹¹ and maximum of 27 sessions¹⁶, both with considerable results, which makes EAT an efficient rehabilitation method, since the results proved to be beneficial regardless of the number of sessions performed.

The riding material most cited in the studies was the blanket, with the participants' feet outside the stirrups. Therefore, we conclude that the use of the blanket becomes important for analyzes and therapeutic processes aimed at children with DS, since the results with this material were positive regardless of the variable studied.

Regarding the number of participants in the studies, only one study¹¹ had the participation of younger children, between the ages of 3 and 5. This number can be justified by the fact that the presence of these children in research involving EAT is more complex, due to the characteristic muscle hypotonia. Of the 8 studies included in this research, 2 involved postural analyzes performed only with male children. It is important to carry out these analyzes with females, as gender bodies are different.

Thus, we can substantiate the EAT positive results after only 8 intervention sessions regardless of the age of the participants. Improvements in motor, linguistic and respiratory developments may influence the child's functional abilities to perform daily tasks. We suggest future studies with the participation of younger children for further scientific substantiation of the method within this age group.

Conclusion

The objective of this systematic literature review as to analyze the publications on EAT as a tool in the global development of children with DS. We can conclude that the scientific evidence found in the reviewed articles indicates that EAT is an effective tool in the global development of children with DS, showing improvement in gait quality and pattern, sphincter control, evolution of balance and body alignment. Important results on muscle strength and coordination were found when using the blanket with participants' feet outside the stirrup. The environment where EAT sessions are conducted foster various verbal stimuli, with expansion of speech possibilities and progress in the respiratory development of the child with DS. As a consequence of these results, it can be concluded that EAT contributes to the global development and functional skills of participants with DS. However, it is very important to carry out more research in this area with results and scientific evidence of EAT.

References

1. Mata CS, Pignata MIB. Síndrome de Down: Aspectos Históricos, Biológicos e Sociais.

II Febrat - Feira brasileira de colégios de aplicação e escolas técnicas, 2014.

2. Trindade AS, Nascimento MAD. Avaliação do Desenvolvimento Motor em crianças com Síndrome de Down. *Revista Brasileira de Educação Especial*. 2016; 22(4): 577-588.
3. Naito M, Aoki S, Kamide A, Miyamura K, Honda M, Nagai A, et al. Gait analysis in Down syndrome pediatric patients using a sheet-type gait analyzer: Pilot study. *Pediatrics International*. 2015; 57(5): 860-63.
4. Carr J, Collins S. Ageing and dementia in a longitudinal study of a cohort with Down syndrome. *J Appl Res Intellect Disabil*. 2014; 27(6): 555-63.
5. Wood W, Alm K, Benjamin J, Thomas L, Anderson D, Pohl L, et al. Optimal terminology for services in the United States that incorporate horses to benefit people: a consensus document. *J Alternative Compl Med*. 2021; 27: 88-95.
6. Policarpo CL, Santos LJ. Avaliação da força muscular respiratória em indivíduos portadores de síndrome de Down. *Rev. Bras Fisioter*. 2010; 14(Supl 1):310.
7. Garner BA, Rigby BR. Human pelvis motions when walking and when riding a therapeutic horse. *Human movement Science*. 2015; 39: 121-137.
8. Rigby BR, Grandjean PW. The efficacy of equine-assisted activities and therapies on improving physical function. *The Journal of Alternative and Complementary Medicine*. 2016; 22(1): 9-24.
9. Matos MA. Instabilidade atlantoaxial e hiperfrouxidão ligamentar na síndrome de down. *Acta Ortop Bras*. 2005; 13(4): 165-7.
10. Brasil, Departamento de Ciência e Tecnologia. Diretrizes metodológicas: elaboração de revisão sistemática e meta-análise de ensaios clínicos randomizados. Brasília. 2012.
11. Principais itens para relatar Revisões sistemáticas e Meta-análises: A recomendação PRISMA. *Epidemiol e Serviços Saúde*. 2015; 24(2): 335-42.
12. Marconi MA, Lakatos EM. Fundamentos de Metodologia Científica. 5ª edição. São Paulo: Atlas, 2003.
13. Shiwa SR, Costa LOP, Moser AD de L, Aguiar I de C, Oliveira LVF de. Pedro: a base de dados de evidências em fisioterapia. *Fisioter Em Mov*. 2011; 24(3): 523-33.
14. Moriello G, Terpstra ME, Earl J. Outcomes following physical therapy incorporating hippotherapy on neuromotor function and bladder control in children with Down syndrome: A case series. *Physical & occupational therapy in pediatrics*. 2019: 1-15.
15. Jackson-Maldonado D. (2021). Hippotherapy and the communicative abilities of children with Down syndrome: a preliminary study. *Communication Disorders Quarterly*,

42(2): 81-92.

16. Espindula AP, Ribeiro MF, Souza LAPS, Ferreira AA, Ferraz MLF, Teixeira VPA, et al. Effects of hippotherapy on posture in individuals with Down Syndrome. *Fisioter Mov.* 2016; 29(3): 497-505.
17. Ribeiro MF, Espindula AP, Ferraz MLF, Ferreira AA, Souza LAPS, Teixeira VPA. Avaliação postural pré e pós-tratamento equoterapêutico em indivíduos com síndrome de Down. *ConsSaude.* 2016; 15(2): 200-9.
18. Costa VSF, Silva HM, Azevêdo M, Silva AR, Cabral LLP, Barros JF, et al. Effect of hippotherapy in the global motor coordination in individuals with Down syndrome. *Fisioter Mov.* 2017; 30(Supl 1): S229-40.
19. Costa VSF, da Silva HM, Alves ED, Coquerel PRS, da Silva AR, Barros JF, et al. Hippotherapy and respiratory muscle strength in children and adolescents with Down syndrome. *Fisioter Mov.* 2015; 28(2): 373-81.
20. Espindula AP, Ribeiro MF, Souza LAPS, Ferreira AA, Teixeira VPA. Avaliação muscular eletromiográfica em pacientes com síndrome de Down submetidos à Equoterapia. *Rev Neurocienc.* 2015; 23(2): 218-226.
21. Berg P, Becker T, Martian A, Primrose KD, Wingen J. Motor control outcomes following Nintendo Wii use by a child with Down Syndrome. *Pediatric Physical Therapy.* 2012; 24(1): 78-84.
22. Chiviacowsky S, Wulf G, Machado C, Rydberg N. Self-controlled feedback enhances learning in adults with Down syndrome. *Revista Brasileira de Fisioterapia.* 2012; 16(3): 191-196.
23. Doralp S. Embracing Variability and Repetition in Practice: A Commentary on Outcomes following Physical Therapy Incorporating Hippotherapy on Neuromotor Function and Bladder Control in Children with down Syndrome: A Case Series. *Physical & Occupational Therapy In Pediatrics.* 2020; 40(3): 261-262.
24. Ribeiro MF, Espindula AP, Ferreira AA, de Souza LAPS, Teixeira VDPA. Electromyographic evaluation of the lower limbs of patients with Down syndrome in hippotherapy. *Acta Scientiarum. Health Sciences.* 2017; 39(1): 17-26.
25. Ribeiro MF, Espindula AP, Júnior DEB, Tolentino JA, da Silva CFR, Araújo MF, et al. Activation of lower limb muscles with different types of mount in hippotherapy. *J Bodyw Mov.* 2017; 22(1): 52-6.
26. Ramos MM, Nabeiro M. The influence of equine assisted services on the balance of a

participant with visual impairment and autism characteristics. Journal of Bodywork and Movement Therapies. 2022.