EFFECT OF RIDING THERAPY ON BEHAVIORAL AND FUNCTIONAL PERFORMANCE IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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ABSTRACT

Autism Spectrum Disorder (ASD) is a clinically diagnosed neurodevelopmental disorder. The treatment of ASD includes both psychosocial and psychopharmacological interventions, of which hippotherapy was highlighted in this study. This therapy uses horses as instruments, and has a fundamental influence on psychological function. This research is an integrative literature review and aims to evaluate the effects of hippotherapy in the treatment of children with autism spectrum disorder based on the analysis of previous studies already carried out. Digital research platforms were used, and descriptors in English "autism" and "hippotherapy" were used. Clinical and randomized controlled studies from the last 10 years were selected, and are presented and discussed in this work. The results suggest that hippotherapy benefits patients with autism in the areas of socialization, communication, self-care, mobility, and coordination, resulting in significant improvements in the symptoms of irritability, hyperactivity, social interaction deficits, and restricted behavior patterns that are part of autism spectrum disorder. Although hippotherapy has demonstrated benefits for patients with ASD, there is a lack of information on the treatment time required to achieve positive long-term results.

***Keywords**: Neurodevelopmental disorders; autism; therapeutic intervention; socialization.*

1 INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by alterations in communication and sensory behaviors. It is strongly associated with genetic inheritance and multifactorial causes. Therefore, it is worth highlighting the existence of a gene associated with the etiology of ASD, which is homologous to phosphatase and tensin (PTEN) (Skelton; Stan; Luikart, 2020).

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The diagnosis is made through behavioral observation and the criteria established by the Diagnostic and Statistical Manual of Mental Disorders 5th edition (American Psychiatric Association, 2013), include persistent deficits in communication and social interaction and restricted and repetitive patterns of behavior. These behaviors are responsible for classifying the severity of the illness into three levels: level 1 “Requiring support”, level 2 “Requiring substantial support”, level 3; “Requiring very substantial support” (American Psychiatric Association, 2013). Symptoms must be present early in the developmental period or until social demands exceed limited capacities, since they cause impairments in social and professional functioning in these individuals (American Psychiatric Association, 2013).

The treatment of ASD aims to mitigate symptoms and includes psychosocial and psychopharmacological interventions, and should be individualized (Sadock; Sadock; Ruiz, 2017). As far as psychosocial interventions are concerned, we have various therapies and methods at our disposal, but in this paper we would like to highlight equine therapy. This therapy uses the horse and has a fundamental influence on psychic function, since it contributes to modifying and establishing desired behaviors in the areas of mobility and self-care, in addition to the effectiveness in bodily stimuli for the child when riding (Silva; Argôlo Azevedo; Santos Marques, 2019).

Thus, the use of horses in treatment seems to be beneficial to the patient, since it achieves the goal of therapy, which, in general, prioritizes improving quality of life in order to minimize the damage, especially in the motor and social areas that the disease causes in the patient’s life (Silva; Argôlo Azevedo; Santos Marques, 2019, Wuang *et al*., 2010, Lanning *et al*., 2014, Ajzenman; Standeven; Shurtleff, 2013).

In view of the above, the purpose of this research was to explore, through an integrative literature review, the effects of equine therapy on behavioral and functional performance and its impact as a therapeutic method for patients with autism spectrum disorder (ASD), contributing to the scientific foundation of professionals and the expansion of this therapy in order to benefit the population studied.

2 MATERIALS AND METHODS

This is an integrative literature review, which provided a broad overview of the topic based on publications on the main digital platforms for scientific articles. There was a need to address the issue due to the small amount of scientific literature

available in databases, in disagreement with the current scenario, which is portrayed by the increased repercussions of autism spectrum disorder (ASD).

A number of steps were taken to carry out the study. The first phase focused on establishing the guiding research question: “What are the benefits of equine therapy in terms of behavioral and motor development for individuals with autism spectrum disorder?”. The authors chose this topic because of its repercussions in society and the possibility of benefiting the population studied by expanding knowledge of equine therapy.

This was followed by documentary research, using scientific articles integrated into the databases: Medline, PubMed, LILACS, PEDro and SciELO. The terms “autism” and “hippotherapy” were used to access them.

For the research design, filters were selected to determine the inclusion criteria of the research, such as: (a) articles published between the years 2011-2021; (b) randomized controlled clinical studies; (c) publications in Portuguese and English. Papers that did not fit these criteria were therefore excluded. Flowchart 1 summarizes the search:

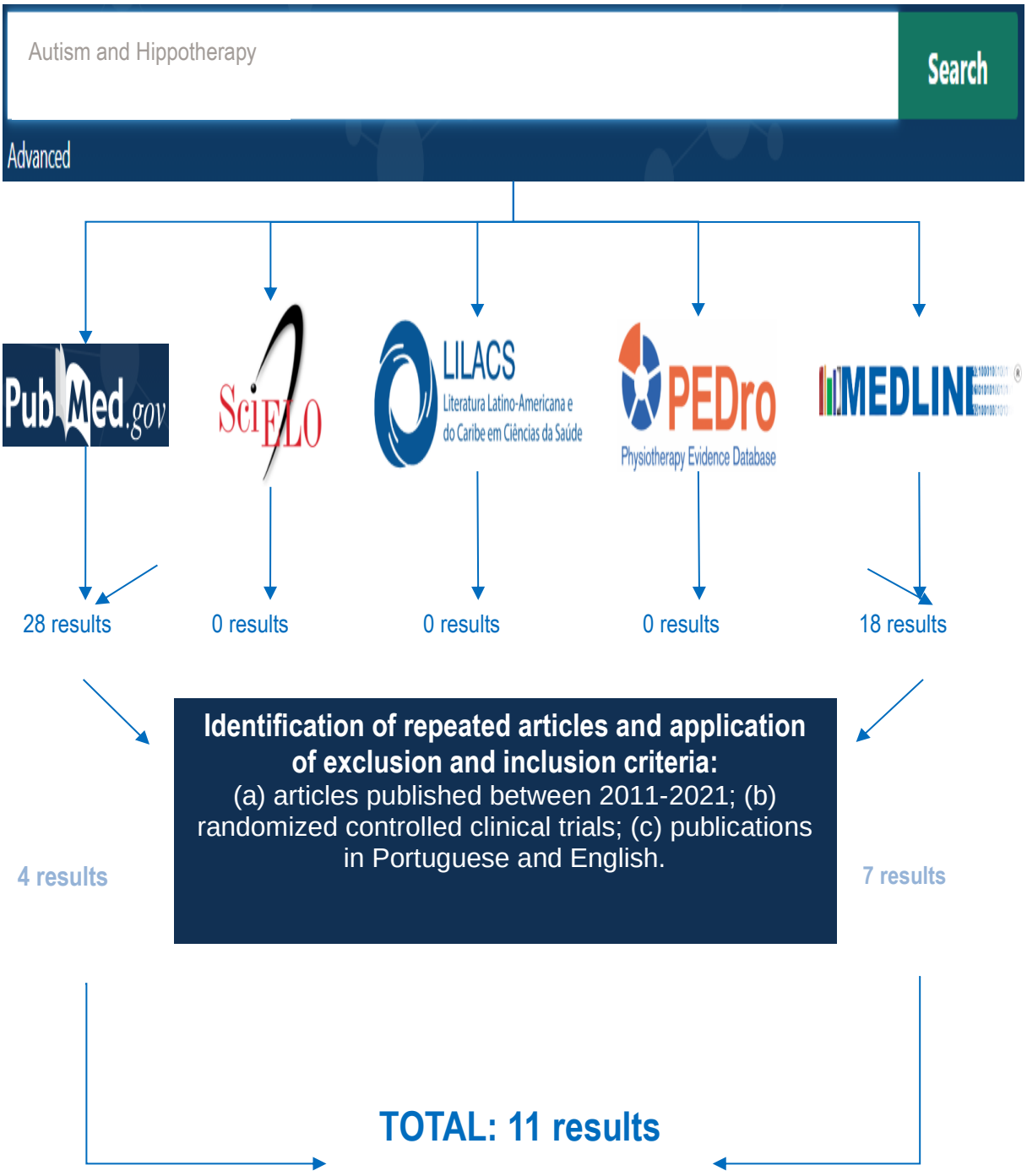

Figure 1: Flowchart of the methodology for filtering the articles used in this study.
Source: Prepared by the authors.

In order to structure the data, the studies that met the inclusion criteria were evaluated, enabling the definition of the relevant information for the presentation, discussion and comparison of the data in a descriptive manner.

3 RESULTS

The table below contains information on the articles analyzed in this study, summarizing their results, conclusions and observations, as well as the authors, study design and number of participants in each study.

Authors/Year of publication Design/sample size (n)	Objective	Observations	Conclusion
Ward *et al.* (2013). **Empirical cause and effect study with a sample group of 21 participants.**	To examine the effectiveness of horse therapy on the social communication and sensory processing skills of autistic children as part of a school group.	An interrupted treatment design was employed to determine whether the children were able to maintain the effects after treatment with horses. The gains, on the other hand, were not consistently maintained after two 6-week breaks from treatment, but were recovered when treatment was resumed.	After 10 weeks of therapy, the teachers' evaluations indicated an improvement in social communication, attention, tolerance and reactions to stimuli in the classroom, with a positive impact on the transfer to the school environment.
Ajzenman, Standeven and Shurtleff (2013). **Pilot study of a single-group pre-post project involving a 12-week equine therapy intervention for 6 autistic children.**	The aim of this research was to determine whether hippotherapy increased function and leisure participation in children with ASD.	No significant changes were observed in more complex skills, such as expressive communication, interpersonal skills, participation in high-demand leisure and household chores. And despite the improved stability, the changes in fine and coarse motor control were inconsistent.	Postural sway decreased significantly after 12 weeks of intervention. Improvements were seen in adaptive behaviors (receptive communication and coping) and in participation in daily activities (self-care, low-demand leisure and social interactions).
Lanning *et al*. (2014). **Case-control study involving 25 children with autism.**	To evaluate the impact of equine therapy on the quality of life of children diagnosed with ASD over a 12-week period.	No relevant information.	The parents noticed significant changes in social, emotional, school and physical functioning after 6 weeks of equine therapy, indicating an improvement in behavior in general.
Anderson and Meints (2016). **Experimental study involving 15 children diagnosed with ASD in a therapeutic horseback riding program.**	To evaluate the effects of a 5-week therapeutic horseback riding program on the social functioning of children and adolescents with ASD.	No relevant information.	Improvement in aspects of social functioning and empathy and positive reduction in maladaptive behaviors, including internalized and non-social behaviors with implications for daily life.
Wuang *et al.* (2010). **Experimental study with a sample group of 60 participants.**	To investigate the effectiveness of a 20-week horseback riding program on motor	Children's active participation in equine therapy affects their psychosocial development. In addition,	Results attest to the positive impact of equine therapy on motor proficiency, with a therapeutic effect on

	proficiency and integration of sensory functions in children with autism.	improvements can be made to the visomotor system, coordination, speed, upper limb coordination and dexterity.	gross motor function sustained for at least 6 months, and on sensory integrative functions.
Steiner and Kertesz (2015). **This is a randomized controlled clinical study with a sample of 26 people who were divided into 2 groups and underwent different therapeutic processes.**	The aim was to investigate equine therapy from a medical point of view and explain why and how it works.	The most important feature of this study is that it is a "double-blind" controlled trial involving a control group that did not receive horse therapy.	Equine therapy is a complex therapy and is suitable for improving the condition of children with autism. It is useful for achieving a better gait and orientation and for improving mental skills. During the research (approximately 6 months), the following parameters were changed: - the length of the gait cycle increased, meaning more stability in the sagittal plane; - mental parameters were better in the riding group.
Petty, Pan and Dechant (2017). **This is a pilot study of a randomized trial involving 67 patients who were divided into 2 groups.**	The aim of the present study was to determine whether 10 weeks of a THR group intervention compared to an active control intervention (i.e. barn activity (BA) group with no contact with the horse) could cause crossover effects for positive changes in participants' interactions with their pets.	This is a pilot study that correlated equine therapy with changes in the emotions of children with ASD towards their pets and family. The study used a Child Attitude and Behavior towards Animals (CABTA) report, which was filled out by the child's caregiver.	The animal attachment score improved significantly in group 1 and group 2 showed no improvement. As for the animal abuse score, there was no significant difference in any of the groups.
Borgi, *et al*. (2016). **This is a randomized controlled clinical study, with N of 28 patients, who were divided into 2 groups.**	The study aims to investigate whether an equine therapy program, included in the activity routine of children with ASD, is capable of positively affecting both adaptive and executive functioning.	A standardized protocol was used, which has already been shown to be effective for a different clinical population (patients with schizophrenia) and was adapted for the research, since the population is patients with ASD who are between 6 and 12 years old. To analyze the results, they used quantifiable measures, including indirect (interviews with parents) and direct	There was a time-dependent improvement in the social functioning of children with ASD taking part in equine therapy sessions (compared to one control group), i.e. an increase in social level sub-scores of the Vineland Adaptive Behavior Scale. In addition, an increase in communication was observed. Regarding the behavioral part, the scale

		(problem-solving task), respectively the Vineland Adaptive Behavior Scale and the Tower of London test).	points in the direction of an improvement in motor skills resulting from participation in equine therapy in children with ASD.
Gabriels, *et al*. (2012). **The design was a randomized controlled study with 127 participants who were divided into 2 groups and had different interventions.**	The primary objective of the study was to evaluate the effectiveness of equine therapy on self-regulation, communication, social interaction, adaptive and motor behaviors in children and adolescents diagnosed with ASD. The secondary objective was to assess the retention of improvements at six months after the intervention phase of equine therapy.	This study has a high level of methodological rigor (i.e. randomized controlled) use of a well-established standardized diagnostic measure of ASD, control group without horses (no barn activities), and intervention methods by therapeutic riding. The fidelity of the intervention was monitored. Participants were assessed within 1 month pre- and post-intervention by assessors blinded to the intervention conditions and non-blinded caregiver questionnaires.	The equine therapy group had significant improvements in the subscales of irritability, hyperactivity, social cognition and communication. They had a significant increase in the use of different words and also spoke more words post-intervention compared to the control group.
Kern, *et al*. (2011). **This is a prospective trial with 24 participants as the final N. The participants were observed at four different times: 3 to 6 months before starting equine therapy, immediately before starting, at 3 months and at 6 months of practicing therapy with horses.**	The aim of the research was to examine the effects of equine-assistedactivities on the overall severity of autism symptoms. The Assessment Scale (CARS) and the quality of interactions between parents and children using the Timberlawn Parent-Child Interaction Scale were used. In addition, this study examined changes in sensory processing, quality of life and parental satisfaction with the treatment.	There were factors that limited the study, as the participants were not randomized into treatment conditions. An additional limitation is that only a small number of children were included in the study. It was difficult to control all the factors and keep them consistent throughout the study, so although every effort was made to keep the child with the same horse and the same instructor throughout the study, some of the ponies and horses became lame or just needed a rest, and there were some changes of instructor. Classes were supposed to be held every week without interruption; however, classes sometimes had to be rescheduled due to the weather.	The results of the study suggest that equine-assisted activities are beneficial for individuals with ASD. In addition to the measured results, the parents expressed that the equine-assisted activities benefited their children and improved their quality of life.

Holm, *et al*. (2014). **This work is a randomized controlled clinical study, with N=3 people, where each participant was given a therapeutic dose, and one participant received the control dose.**	The aim of the study was to evaluate the impact of 3 doses of therapeutic horseback riding (1, 3 and 5 times a week) on three target behaviors identified by the parents.	The study's generalizability was limited to the inclusion criteria, demographic data and clinical characteristics of each of the participants. In addition, the parents were not masked for the general purpose of the study. Add to this the fact that the participants had been riding once a week for about a year, they had already mastered any fears associated with tacking, grooming or riding.	Increasing the number of weekly therapeutic riding sessions did not seem to have an impact on the number of positive behavioral changes, but it did have an impact on the magnitude of these changes - mainly for the better. Some behaviors changed for the worse in each phase during the riding sessions, however there was an impact of the riding sessions on the target behaviors at home and in the community, which were uniformly positive. Of all the target behaviors, it was spontaneous verbalization that consistently increased, and all the parents also reported that their children had improved in terms of following instructions at home and in the community. There were also positive changes in core strength and coordination.

Table 1: Synopsis with authors, year, design, sample number, objective, results, conclusion and observations of the articles selected and analyzed in this study
Caption: *Articles without relevant observations on methodological processes, results and/or study design.
Source: Prepared by the authors.

4 DISCUSSION

The results of the integrative literature review provide preliminary evidence that a therapeutic horseback riding program is beneficial for individuals with autism spectrum disorder in basic and advanced activities of daily living because, through horseback riding, three-dimensional movements cause the practitioner's body to undergo various sensory and neuromuscular stimuli (Costa, 2020, p. 12).

According to Wuang *et al*. (2010), patients with ASD have sensory and perception disorders, as well as motor deficits, which can be reflected in unusual postures and movements, poor posture and lack of stability. It is therefore necessary to offer therapeutic options to reduce the impact of symptoms on the lives of patients and their families.

The study by Ajzenman, Standeven and Shurtleff (2013) used weekly equine therapy for 12 weeks, in which 6 children with ASD aged between 5 and 12 took part. Behavioral scales were used, as well as a video motion capture system and force platform for pre- and post-intervention analysis. The result was a reduction in postural sway, as well as improvements in adaptive behaviors such as receptive communication and coping and participation in self-care activities, low-demand leisure and social interactions.

Silva (2012) states that children with ASD have a tendency towards hyperkinesis, which directly affects static balance. The deficit related to postural control has a direct influence on the restrictive and repetitive behaviors that characterize ASD and, when associated, the altered motor mechanisms interfere with the daily activities of these individuals (Bojanek *et al*., 2020). Furthermore, this alteration is correlated with social impairment, such as isolation, anxiety and emotional challenges (Hilton *et al*., 2012).

Supporting the hypothesis of the effectiveness of behavioral treatment, the study by Bender and Guarany (2016) used the Pediatric Evaluation of Disability Inventory (PEDI) and the Functional Independence Measure (FIM) as a tool, applied to caregivers (n=28; 14 in each group) of individuals with ASD who practice and do not practice equine therapy. There was a difference in the functional performance of children who practiced equine therapy assessed by the PEDI in the area of Self-Care (p=0.041) and Mobility (p=0.001). There was no difference in the group assessed by the MIF (p=0.384).

Thus, according to the findings of the study by Ajzenman, Standeven and Shurtleff (2013), equine therapy, by affecting basic motor skills, provides support for the development of complex motor skills, which enable greater progress in daily activities in the individual and social spheres. Therefore, it is of great importance that motor stimulation is introduced at an early age, and equine therapy proves to be a good resource for developing motor skills (Bruzek, 2014, Lermontov, 2004).

The study by Steiner and Kertesz (2015) assessed the gait cycle of the participants and showed that the subjects who underwent equine therapy saw an improvement in the kinetics and kinematics of gait with increased walking efficiency, as a result of advances in the coordination, stability and orientation of the participants, as well as better development in mental parameters. In comparison, in the control

group, in which the participants did not receive physiotherapy associated with equine therapy, there was an increase in asymmetry when walking.

These findings allow behavioral treatments, such as balance training, to advance in the therapy and subsequent prevention of alterations in other motor skills (Fournier *et al*., 2010). In this context, equine therapy is a useful treatment strategy that uses the horse's gait to provide motor and sensory stimuli where the horse's movements encourage the rider to balance and posture, improving postural mobility (Koca; Ataseven, 2016).

According to the study by Annett (1999), who described the rightward gene shift theory, the rightward asymmetry typical of ASD may be a characteristic that affects sensory and motor functions, as well as cognitive functions (including language). Therefore, the diagnosis of autism established by the DSM-V includes deficits in communication and social interaction.

These, in turn, associated with symptoms of irritability and hyperactivity, can compromise functionality in school and family environments (Gabriels *et al*., 2012). It is important to emphasize that children and adolescents with autism encounter difficulties when they enter the school environment and these obstacles extend from the characteristics of the disorder, which cause delays in child development, to the difficulties of teachers in dealing with these individuals (Oliveira, 2020).

From this context, Ward *et al*. (2013) point out that equine therapy has a positive impact on education, since evaluations with teachers indicated that these students showed improvements in social communication, attention, tolerance and reactions to stimuli in the classroom. It is therefore a valuable practice, since school inclusion is a space for learning and developing social competence (Camargo; Bosa, 2009).

Para Lanning *et al*. (2014), who evaluated the impact of equine therapy on the quality of life of children with ASD by applying a questionnaire, the positive changes in social, emotional, physical and school functioning were noticed by the parents after 6 weeks of equine therapy. These results, associated with equine therapy, are due to the harmony between the therapeutic object and the participant. Horses, being sociable animals, respond to the slightest human stimuli and this provides learning about cause and effect for individuals with ASD and an understanding of the impact of behaviors on society (Gabriels *et al*., 2012).

Thus, Petty, Pan and Dechant (2017) point out that the score of attachment to the pet improved in patients who practiced equine therapy, while in participants who did not have this contact with the horse, the score did not improve significantly. The same result for both groups occurred in relation to “acting in a caring way with the animal”, thus showing a positive result for the improvement of ASD symptoms.

The work of Gabriels *et al*. (2015), in turn, evaluated the benefits of equine therapy on self-regulation, socialization, communication, adaptive and motor behaviors in children with ASD. The participants were randomized into 2 groups for 10 weeks, with the case group using equine therapy and the control group using activity in a barn without horses, but with similar methods. The therapeutic riding group made progress in measures of irritability, hyperactivity, social cognition and communication.

It is believed that horse therapy causes these effects due to the need for joint attention skills for the development of therapy and also the rhythmic movement of the horse, which with its warmth, causes relaxation that calms patients (Gabriels *et al*., 2015). Corroborating this, Borgi *et al*. (2016) reported that children who attended equine therapy showed development in the socialization, social functioning and executive skills domains after a period of 6 months, through the team sessions.

On the other hand, Anderson and Meints (2016) state in the results of their study that equine-assisted therapy tends to have positive effects on autistic children, including a reduction in maladaptive behaviors and an improvement in empathy. However, the authors did not observe significant changes in general adaptive behaviors, such as communication and socialization.

At the same time, supporting the hypothesis that equine therapy is effective, Wuang *et al*. (2010) reported a positive and sustained impact on gross motor function, coordination, speed, the visomotor system and social integrative functions. In this context, Harris and Williams (2017) also present valuable results regarding changes in social functioning and a reduction in the severity of autism and hyperactivity symptoms. However, no significant results were found in the context of lethargy, stereotypy and irritability.

The effects of equine therapy, according to Cruz and Pottker (2017), contribute to physical, mental and social aspects. The child’s interaction with the environment leads to the development of rhythm, posture, balance, temporal orientation, as well as new forms of socialization, self-confidence and increased cognitive capacity. Equine

therapy is therefore a promising therapeutic method for individuals on the autistic spectrum.

The research by Kern *et al*. (2011), who evaluated 20 children with ASD who underwent equine therapy treatment for 6 months, showed that, although no statistically significant changes were observed in the scores during the pre-treatment period, there was significant progress in tone, mood and interaction between parents and children after 3 and 6 months of equine therapy. In addition, there were improvements in the quality of life of the children assessed by their parents, including in the pre-treatment waiting period.

There is no consensus on the ideal duration of treatment and the weekly frequency of therapeutic riding sessions for children with ASD. Among the studies analyzed in this paper, the time spent in equine therapy ranged from 5 weeks to 1 year and the number of sessions varied from 1 to 5 times a week. Wuang *et al*. (2010) propose in their work a 20-week riding program, consisting of 2 sessions per week, which generates a therapeutic effect of at least 24 weeks on motor and sensory function.

In the past, according to Holm *et al*. (2014) who reported on the relationship between the weekly amount of horse therapy over a 12-week period and target behaviors, showing that greater amounts of horse therapy do not seem to influence the number of positive behavioral changes. On the other hand, the increase in the number of weekly riding sessions affected the magnitude of the changes for the better and had a positive effect on the participants' target behavior, both in the social environment and at home.

5 CONCLUSION

Based on the selected studies, the effectiveness of equine therapy can be observed in the areas of socialization, communication, self-care, mobility and coordination, reflecting in significant improvements in the symptoms of irritability, hyperactivity, social interaction deficits and the restricted patterns of behavior that make up the autism spectrum disorder. The horse acts as a therapeutic tool capable of providing bodily stimuli, which originate from the rhythmic movements of the animal's gait, which enable postural control and adaptation of motor function. In addition, riding and group activities reflect new forms of socialization and self-confidence.

It is important to note that, although equine therapy has physical, psychological, educational and social benefits, the literature lacks information on the length of treatment needed to achieve positive long-term results. Therefore, there is a need to develop studies with the aim of generating more data that provide cost-effectiveness in patient care, expanding knowledge and the realization of practice by institutions.

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