Insights on cognitive effects of hippotherapy in children with Autism Spectrum Disorder and intellectual disability in Brazil

Percepções sobre os efeitos cognitivos da equoterapia em crianças com Transtorno do Espectro Autista e deficiência intelectual no Brasil

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ABSTRACT
Hippotherapy has been used as a rehabilitative treatment in several pathologies, with behavioral and cognitive changes. Therefore, this study aimed to analyze the profile of hippotherapy practitioners in Brazil and identify the effects of hippotherapy on the cognitive aspects of children with Autism Spectrum Disorder (ASD) and Intellectual Disability (ID). Mixed procedures were carried out with professionals and guardians of practitioners present in centers located in the state of Paraíba, Brazil, and application of online questionnaires based on pre-existing assessments. Resulting in a neurological clinical profile of the practitioners and a similarity between the structures and organization of the analyzed riding therapy centers. There were significant responses in the cognitive areas associated with behavior, environmental interaction and empathy of practitioners with ASD and ID. These results indicate that hippotherapy promotes the cognitive development of children with ASD and ID.
Keywords: cognition, hippotherapy, Autistic Spectrum Disorder.

RESUMO
A equoterapia tem sido utilizada como tratamento reabilitador em diversas patologias, com alterações comportamentais e cognitivas. Portanto, este estudo teve como objetivo analisar o perfil dos praticantes de equoterapia no Brasil e identificar os efeitos da equoterapia nos aspectos cognitivos de crianças com Transtorno do Espectro Autista (TEA) e Deficiência Intelectual (DI). Procedimentos mistos foram realizados com profissionais e responsáveis pelos praticantes presentes em centros localizados no estado da Paraíba, Brasil, e aplicação de questionários online com base em avaliações pré-existentes. Resultando em um perfil clínico neurológico dos praticantes e uma semelhança entre as estruturas e organização dos centros de equoterapia analisados. Houve respostas significativas nas áreas cognitivas associadas ao comportamento, interação ambiental e empatia dos praticantes com TEA e DI. Esses resultados indicam que a equoterapia promove o desenvolvimento cognitivo de crianças com TEA e DI.

Palavras-chave: cognição, equoterapia, Transtorno do Espectro Autista.

1 INTRODUCTION

Autism Spectrum Disorder (ASD) is part of a group of complex neurobiological disorders, whose diagnosis is composed of two central domains: social and communication deficits and repetitive and restricted patterns of behavior, interests or activities (DUARTE et al., 2019). Thus, it can be classified as mild, moderate or severe depending on adaptive difficulties, developmental delays and severity (SWEDO et al., 2014). Although ASD is predominantly studied, there is no proven etiology, however, some genetic and environmental factors are pointed out as the main hypotheses for the cause of ASD. Some researchers claim the etiology of ASD as multifactorial, with predominance of males with ratio of four boys to one girl (STEINER, 2015; SWEDO et al., 2014).

The manifestations and symptoms of ASD start before the age of three, with the main characteristics of difficulty in socialization, stereotyped movements, restrictive behaviors, hypersensitivity, repetitive behavior, difficulty in relaxation, anxiety, lack of concentration and delay in psychomotor development, in addition to changes in cognitive aspects, which are part of the faculty of knowledge, that is, the set of functions that the individual receives - stores and transforms information, including: learning and attention, memory, thinking or judgment (DUARTE et al., 2019; STEEN et al., 2019; O’HAIRE et al., 2013).

Due to different approaches, the cognitive processes of children with ASD can be assessed through language skills, memory, learning, joint attention, social and environmental
socialization, communication, behavior and emotions. Treatment involves an interdisciplinary approach and, in some cases, medications aimed at minimizing target symptoms are included (TAN, 2018; LANNING et al., 2014). Among the various treatments and therapies aimed at people with ASD, there is riding therapy, a therapeutic and educational method, whose main kinesiotherapy tool is horses that work together with different re-educational techniques, capable of influencing stimulation and motor development, sensory and behavioral, through the playful-sports activities and the three-dimensional movement performed by the horse when moving in step. Thus, the target audience of hippotherapy are people with special needs and/or disabilities, who seek global and biopsychosocial development in hippotherapy (FERNÁNDEZ, 2015; AJZENMAN et al., 2013).

However, the effectiveness of hippotherapy as a therapeutic resource for children with ASD and/or delays in the development of specific areas of the brain, such as Intellectual Disability (ID) or Intellectual Development Disorder, which is characterized by having limitations in general mental abilities, such as: intelligence, reasoning activities, adaptive behaviors, language, memory, cognitive, social and others. As for ASD, ID also has a high incidence in males and is commonly present in hippotherapy centers. Despite these common aspects, there is still a difficulty in carrying out researches and disseminating viable therapeutic interventions for children, caregivers and services health systems in the countries, mainly in countries where there is a growing number of cases of children with ASD and/or ID who practice horse-assisted therapies, as is the case in Brazil, which has a high number of hippotherapy practitioners diagnosed with ASD/Autism or ID isolated or associated with ASD (DUARTE et al., 2019).

Therefore, this study aimed to analyze the profile of hippotherapy practitioners in the state of Paraíba, Brazil and identify the effects of hippotherapy on the cognitive aspects of children with ASD and/or ID, through the perspective of the practitioners’ parents or legal guardians.

2 METHODS

This research was approved by the Research Ethics Committee Involving Human Beings of the University Federal of Campina Grande – UFCG, under protocol number 4.143.768.
2.1 SELECTION OF RIDING THERAPY CENTERS

The research was carried out in three hippotherapy centers located in the state of Paraíba, Brazil, namely: Association of Parents and Friends of the Disabled (APAE) in the municipality of Areia; Association of Riding Therapy of the State of Paraíba (ASPEQ) in João Pessoa; and the Center Equestrian EquoPatos in Patos. It is noteworthy that the research scenarios were the only ones that were willing to participate voluntarily during the period of COVID-19 pandemic, so it was not possible to expand the sample size.

2.2 PARTICIPANTS

Six professionals who work in hippotherapy centers participated in the study, of which two, in addition to being hippotherapists, acted as managers of the centers. A total of 153 practitioners were treated at the hippotherapy centers, 52 diagnosed with ASD and 11 with DI. Of these, 21 legal guardians of children with ASD and/or ID participated who regularly (once a week) attended these centers.

2.3 PROCEDURES AND INSTRUMENTS

This research was carried out in two stages, consisting of blended procedures and online platforms. The first, with a survey of hippotherapy centers located in the state of Paraíba, Brazil, followed by field research, through semi-presenteral contact with professionals working in the centers and the application of an online questionnaire on the organizational aspects and structures of the equine therapy centers. The second, descriptive and evaluative assessing of cognitive effects in children with ASD and/or ID who practice hippotherapy, through a questionnaire aimed at the legal guardians of the practitioners.

The instruments used were questionnaires carried out via electronic address (online) through the Google Forms platform due to the period of COVID-19 pandemic. Both questionnaires were developed by the authors and health and education professionals, based on the assessments used by the riding therapy centers and the assessment topics of the Brief Cognitive Screening Battery (NITRINI et al., 1994). They were called Questionnaire I – organizational, and Questionnaire II – for parents or legal guardians.

Questionnaire I was used to analyze the profile of hippotherapy centers, which addressed topics related to organizational and structural aspects of hippotherapy centers or associations,
such as: physical structure, active professionals, number of practitioners, clinical profile of practitioners, frequency of weekly and monthly visits, number of animals available for equestrian activities and administrative characteristics. In all, six professionals from the hippotherapy centers were responsible for the data obtained in Questionnaire I.

The cognitive effects were analyzed based on the observations and perspectives of the practitioners' legal guardians, through Questionnaire II. This questionnaire consisted of three stages, the first with sociodemographic data of those responsible for and practitioners of hippotherapy, such as: name, city in which they live, identification of the person responsible for the answers and data related to the child, such as gender, age, diagnosis of clinical ASD and/or ID, anamnesis, scholar degree and type of communication performed by the child. The second stage contained information about the performance of hippotherapy, that is, if the child participates in other therapies, place where the hippotherapy is performed, number of weekly sessions, shift and time of hippotherapy practice. The third stage of the Questionnaire II, composed of questions aimed at the observations of the practitioners' legal guardians after the beginning of the hippotherapy sessions, totaling 14 questions subdivided into the three main cognitive areas: cognitive (social cognitive, communication, behavior, attention and planning; visual processing, auditory, memorization and comprehension), social (social interaction, environmental interaction and social motivation) and emotional (social affective and empathy), associated with the main topics of the assessment Brief Cognitive Screening Battery (NITRINI et al., 1994), such as learning, recognition of figures or objects, memory, language and others.

To ensure the reliability of the Questionnaire II data, all questions from the third stage had objective answers, through a numerical scale in which each segment scores from 1 to 5 according to the following characteristics: 1 - There were no changes, 2 - Regressed or had negative responses, 3 - There were few positive changes, 4 - There were positive changes, and 5 - There were many positive changes. It is noteworthy that those responsible for the practitioners had access and agreed with the Informed Consent Form.

2.4 STATISTICAL ANALYSIS

To compare the frequencies among the categories of each variable, the adherence G test or Chi-square test were used. Tests were performed on the R environment (R CORE TEAM, 2019), RStudio interface (version 1.1.463). The significance level adopted was 5% (P-value ≤ 0.05).
3 RESULTS

3.1 ORGANIZATIONAL, STRUCTURAL AND PROFILE ANALYSIS

The three hippotherapy centers shared the following characteristics: classification as a philanthropic association; active for more than six years with equestrian activities/therapies; working hours for professionals of less than ten hours per week and free services for all individuals. In addition to services, they also offer riding lessons and courses related to hippotherapy.

As for the structural aspects of the centers, only one center did not have a covered area for therapeutic practice; all have a place to saddle the horse, sandy soil and ramps that facilitate service. Regarding the horses used in the hippotherapy sessions, constant evaluations, training and follow-ups are carried out to ensure the well-being and health of the animal, through specialized assistance provided by horse riding professionals and veterinarians. It is worth mentioning that the number of horses present in the centers correspond to the number of sessions carried out during the week (eight horses in the first center, four horses in the second center and two in the third hippotherapy center, which perform an average of 109, 30 and 12 weekly sessions, respectively), which are equivalent to an individual hippotherapy session per week with an average duration of 20 to 30 minutes.

With regard to the profile of the professionals present in the centers, the multidisciplinary character of the teams, composed of physiotherapists, psychologists, physical educators, veterinarians, horseback riding professionals, pedagogues and/or psychopedagogues, stands out. The presence of occupational therapists, social workers and physicians was observed in two analyzed centers. As for the clinical profile of practitioners, there is a high number of children and adolescents with neurological disorders or syndromes, especially ASD, Cerebral Palsy, DI and Down Syndrome.

Table 1 presents the general characteristics of the 21 children who practiced hippotherapy. Most children were female (52.4%), aged between five and nine (66.9%), with ASD (61.9%) and with incomplete primary education (71.4%); however, there was statistical significance for age, special needs and schooling.
Table 1. General characteristics of children who practiced hippotherapy

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Total number of children</th>
<th>Frequency (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>10</td>
<td>47.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11</td>
<td>52.4</td>
<td>1.000</td>
</tr>
<tr>
<td>Age (years)</td>
<td>Up to 4</td>
<td>3</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 to 9</td>
<td>14</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 to 12</td>
<td>4</td>
<td>19</td>
<td>0.005</td>
</tr>
<tr>
<td>Special need</td>
<td>Autism Spectrum Disorder</td>
<td>13</td>
<td>61.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intellectual Disability</td>
<td>2</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Down’s syndrome</td>
<td>1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cerebral palsy</td>
<td>3</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global Developmental Delay</td>
<td>1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dravet syndrome</td>
<td>1</td>
<td>4.8</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Scholar degree</td>
<td>Incomplete elementary school</td>
<td>15</td>
<td>71.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incomplete high school</td>
<td>1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complete high school</td>
<td>1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Illiterate</td>
<td>4</td>
<td>19</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Source: own authorship, 2022

3.2 ANALYSIS OF COGNITIVE EFFECTS

Data analysis revealed high proportion of scores 4 and 5 (positive changes and many positive changes, respectively) in all cognitive aspects, with statistical significance for behavior, environmental interaction and empathy (P-value < 0.05). Children presented proportion ≥ 70% for scores 4 and 5 regarding these significative effects (Table 2). It’s noteworthy the absence of negative or regression effects (score 2).

Table 2. Cognitive aspects of practitioners (n = 15) with Autism Spectrum Disorder and Intellectual Disability, observed after the practice of hippotherapy.

<table>
<thead>
<tr>
<th>Cognitive aspects</th>
<th>Scores</th>
<th></th>
<th></th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (%)</td>
<td>2 (%)</td>
<td>3 (%)</td>
<td>4 (%)</td>
<td>5 (%)</td>
</tr>
<tr>
<td>Communication</td>
<td>...</td>
<td>2 (13.3)</td>
<td>8 (53.3)</td>
<td>5 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Behavior</td>
<td>1 (6.7)</td>
<td>...</td>
<td>9 (60)</td>
<td>2 (13.3)</td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td>2 (13.3)</td>
<td>...</td>
<td>7 (46.7)</td>
<td>5 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>2 (13.3)</td>
<td>...</td>
<td>4 (26.7)</td>
<td>4 (26.7)</td>
<td></td>
</tr>
<tr>
<td>Social interaction</td>
<td>...</td>
<td>...</td>
<td>10 (66.7)</td>
<td>5 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Environmental interaction</td>
<td>1 (6.7)</td>
<td>...</td>
<td>9 (60)</td>
<td>3 (20)</td>
<td></td>
</tr>
<tr>
<td>Social motivation</td>
<td>2 (13.3)</td>
<td>...</td>
<td>8 (53.3)</td>
<td>5 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Social affection</td>
<td>1 (6.7)</td>
<td>...</td>
<td>5 (33.3)</td>
<td>7 (46.7)</td>
<td></td>
</tr>
<tr>
<td>Empathy</td>
<td>3 (20)</td>
<td>...</td>
<td>10 (66.7)</td>
<td>1 (6.7)</td>
<td></td>
</tr>
</tbody>
</table>

Source: own authorship, 2022
4 DISCUSSION

The equine therapy centers investigated in this research have structures and practical functioning similar to the National Association of Riding Therapy (ANDE) in Brazil, such as an environment with covered and outdoor areas, places for animal fences, sandy soil and access ramps (ANDE-BRASIL, 2010). Other factors observed in the centers were the composition of the multidisciplinary teams that correspond to the professionals established by Law No. 13,830 of May 13, 2019, which establishes physicians, veterinarians, physiotherapists, psychologists, horse riders, education professionals, speech therapists and occupational therapists as professionals capable of working in hippotherapy centers, depending on the needs of practitioners (BRASIL, 2019).

When observing the special needs of practitioners, the neurological clinical profile, with a high number of cases of male practitioners with ASD and ID (61.9%), corroborating the results of studies that focused on ASD and hippotherapy in other countries (PETTY et al., 2017; ANDERSON, 2016; STEINER, 2015).

Regarding the cognitive areas of practitioners with ASD and ID, we identified positive changes in three cognitive areas (behavior, environmental interaction and empathy) after the hippotherapy interventions. Positive responses associated with behavior are reported as one of the main outcomes associated with exposure and intense contact with horse-assisted activities and therapies, which are reflected in reduced irritability, stereotypies, aggression, inattention, and general behavior changes (VIEIRA et al., 2020; ANDERSON, 2016; LANNING et al., 2014; GHORBAN et al., 2013).

For Petty et al. (2017), in addition to the effects associated with exposure to hippotherapy, there are also changes resulting from the stimuli offered to practitioners linked to the horse's sensorimotor system, which are capable of producing spontaneous neural plasticity in practitioners, thus influencing the development of skills related to behavior and interaction with the environment. It is noteworthy that environmental interaction is also associated with interaction between horse and rider, given the characteristics of horses that, despite being considered large, are highly sociable and receptive to subtle human stimuli, unlike individuals with ASD and DI, thus enabling more concrete learning about understanding behavior, sensory processing, functionality and social interaction (VIEIRA et al., 2020; DUARTE et al., 2019; TAN, 2018; FERNÁNDEZ, 2015; GHORBAN et al., 2013; GABRIELS et al., 2012).
Another cognitive aspect with positive responses related to the interaction and stimuli provided by horses was empathy, as stated by Anderson (2016) when they reported the activation of the limbic system (responsible for emotions) of the practitioner, suggesting an affective bond called man/horse symbiosis, responsible for providing significant positive changes in emotional aspects and feelings of empathy.

Given the data presented, it is concluded that hippotherapy promotes positive effects on the cognitive aspects of children with ASD and ID, highlighting the behavioral cognitive areas, environmental interaction and empathy. However, taking into account the perception of the practitioners' legal guardians, we can also highlight the areas focused on social interaction and motivation.

This study provided clinical evidence of the effectiveness of hippotherapy in the cognitive development of children with ASD and ID, reflecting an important possibility for cognitive rehabilitation. Despite some limitations, such as the COVID-19 pandemic period, which made it impossible to increase the sample size and the lack of standardization of assessment instruments involving cognitive aspects and hippotherapy, justifying the elaboration and adaptations of the questionnaires by the authors and others professionals.

5 CONCLUSIONS

It is estimated that in Brazil there are approximately 2 million children with Autism Spectrum Disorder (ASD) and/or Intellectual Disability (ID), the growing number of diagnoses of these conditions has become one of the main reasons for the search for therapeutic alternatives capable of promote cognitive development. Considering that the cognitive area presents greater impairment in cases of ASD and ID, especially in behavioral functions and social interaction. Thus, hippotherapy is one of the main therapies currently used, however there is a relatively smaller number of researches on hippotherapy associated with cognitive effects in children with ASD and ID. Thus, this study provided insights into clinical evidence of the effects of hippotherapy on the cognitive development of children with ASD and ID.
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