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**NATÁLIA SOARES OLIVEIRA**

**ANÁLISE DO PERFIL E DOS EFEITOS COGNITIVOS EM CRIANÇAS COM  
TRANSTORNO DO ESPECTRO DO AUTISMO OU DEFICIÊNCIA INTELECTUAL  
PARTICIPANTES DE EQUOTERAPIA NO SERTÃO PARAIBANO**

**PATOS - PB  
2022**

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**Dissertação apresentada ao Programa de Pós-Graduação em Ciência e Saúde Animal do Centro de Saúde e Tecnologia Rural da Universidade Federal de Campina Grande, como requisito parcial para obtenção do título de Mestra em Ciência e Saúde Animal.**

**Orientador: Professor Dr. Sérgio Santos de Azevedo.**

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## FOLHA DE ASSINATURA PARA TESES E DISSERTAÇÕES

NATÁLIA SOARES OLIVEIRA

**ANÁLISE DO PERFIL E DOS EFEITOS COGNITIVOS EM CRIANÇAS COM TRANSTORNO DO ESPECTRO DO AUTISMO OU DEFICIÊNCIA INTELECTUAL PRATICANTES DE EQUOTERAPIA NO SERTÃO PARAIBANO**

Dissertação apresentada ao Programa de Pós-Graduação em Ciência e Saúde Animal como pré-requisito para obtenção do título de Mestre em Ciência e Saúde Animal.

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“Onde há Fé, há Milagres.  
Onde há Oração, tem Vitórias.”

## RESUMO

O Transtorno do Espectro Autista - TEA é um transtorno do neurodesenvolvimento que se caracteriza pelos comportamentos estereotipados e dificuldades nas habilidades sociocomunicativas, cuja a etiologia apresenta-se de forma multifatorial e o diagnóstico está associado as manifestações clínicas, como: déficits na comunicação, alterações comportamentais, hipersensibilidade, atrasos psicomotores, alterações nas habilidades cognitivas e outros. A partir dessas manifestações clínicas buscou-se métodos terapêuticos capazes de promover o desenvolvimento biopsicomotor das crianças com TEA, a exemplo da Equoterapia que envolve uma abordagem inter/multidisciplinar nas áreas de saúde, educação e equitação, através da utilização do cavalo como principal ferramenta cinesioterapêutica capaz de proporcionar ao praticante benefícios nos aspectos motores, sensoriais, comportamentais e sociais, resultando assim, no desenvolvimento biopsicossocial e sensorio-motor. Tendo em vista esses aspectos, a equoterapia é uma das alternativas de terapia complementar que melhor atende às particularidades das crianças com TEA e/ou Deficiência Intelectual - DI na atualidade, justificando assim o crescente número de crianças com TEA e DI nos centros e associações de equoterapia. Dessa forma, buscou-se analisar o perfil clínico e os efeitos da equoterapia nos três principais domínios cognitivos de crianças com TEA e/ou DI praticantes de equoterapia no estado da Paraíba – Brasil, por meio de dois capítulos que integram esta dissertação. O capítulo I, descreveu os benefícios das terapias com equinos nas áreas cognitivas de crianças com TEA/autismo, por meio de uma revisão sistemática e metanálise de 29 estudos referentes ao tema. No qual, os resultados encontrados apontaram melhoras significativas nas seguintes áreas cognitivas: cognitivo social, comportamental, comunicação e social afetivo. No capítulo II, analisou o perfil clínico dos praticantes de equoterapia no Estado da Paraíba, Nordeste do Brasil e os efeitos da equoterapia nos aspectos cognitivos de crianças com TEA e DI. Sendo analisados dados e observações presentes em três centros de equoterapia, localizados nos municípios de Areia, João Pessoa e Patos. Através de procedimentos semipresenciais e questionários eletrônicos (online), desenvolvidos pelos autores e profissionais interdisciplinares atuantes em centros de equoterapia. A aplicação dos questionários ocorreu em dois momentos: o primeiro associado à organização e estrutura dos centros, com participação de profissionais e gestores dos centros; e o segundo referente aos efeitos cognitivos pelas perspectivas dos responsáveis legais dos praticantes. Como resultados, identificou-se que os centros possuem estruturas físicas adequadas para realização dos atendimentos de equoterapia e predomínio dos praticantes com perfil clínico neurológico, além de elevados números de casos de praticantes com TEA e multideficiências. Com relação aos efeitos cognitivos analisados em uma amostra de 15 praticantes com TEA e DI, observou-se efeitos positivos nos três domínios cognitivos, destacando-se as áreas cognitivas e o cognitivo social. Desse modo, este estudo é de grande relevância para as crianças e indivíduos em geral com TEA e DI, tendo em vista que os benefícios da equoterapia nos aspectos cognitivos não se encontram aclarados na literatura.

**PALAVRAS-CHAVE:** Cognição; Equoterapia; Transtorno do Espectro Autista.

## ABSTRACT

Autism Spectrum Disorder - ASD is a neurodevelopmental disorder that is characterized by stereotyped behaviors and difficulties in socio-communicative skills, whose etiology is multifactorial and the diagnosis is associated with clinical manifestations, such as: communication deficits, behavioral changes, hypersensitivity, psychomotor delays, changes in cognitive abilities and others. From these clinical manifestations, I sought therapeutic methods capable of promoting the biopsychomotor development of children with ASD, such as Equine Therapy, which involves an inter/multidisciplinary approach in the areas of health, education and riding, through the use of the horse as the main kinesiotherapeutic tool capable of provide the practitioner with benefits in motor, sensory, behavioral and social aspects, thus resulting in biopsychosocial and sensorimotor development. In view of these aspects, hippotherapy is one of the complementary therapy alternatives that best meets the particularities of children with ASD and/or Intellectual Disability - ID today, thus justifying the growing number of children with ASD and DI in centers and associations of hippotherapy. Thus, we sought to analyze the clinical profile and the effects of hippotherapy on the three main cognitive domains of children with ASD and/or ID who practice hippotherapy in the state of Paraíba - Brazil, through two chapters that are part of this dissertation. Chapter I, which described the benefits of equine therapies in the cognitive areas of children with ASD/autism, through a systematic review and meta-analysis of 29 studies on the topic. In which, the results found showed significant improvements in the following cognitive areas: social cognitive, behavioral, communication and social affective. In chapter II, it analyzed the clinical profile of practitioners of hippotherapy in the State of Paraíba, Northeast of Brazil and the effects of hippotherapy on the cognitive aspects of children with ASD and ID. Data and observations present in three hippotherapy centers located in the cities of Areia, João Pessoa and Patos were analyzed. Through blended procedures and electronic (online) questionnaires, developed by authors and interdisciplinary professionals working in hippotherapy centers. The application of the questionnaires took place in two moments: the first associated with the organization and structure of the centers, with the participation of professionals and managers of the centers; and the second referring to the cognitive effects from the perspectives of the practitioners' legal guardians. As a result, it was identified that the centers have adequate physical structures to carry out hippotherapy treatments and a predominance of practitioners with a neurological clinical profile, in addition to high numbers of cases of practitioners with ASD and multiple disabilities. Regarding the cognitive effects analyzed in a sample of 15 practitioners with ASD and ID, positive effects were observed in the three cognitive domains, highlighting the cognitive and social cognitive areas. Thus, this study is of great relevance for children and individuals in general with ASD and ID, given that the benefits of hippotherapy in cognitive aspects are not clarified in the literature.

**KEY-WORDS:** Cognition; Hippotherapy; Autistic Spectrum Disorder.



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## LISTA DE ABREVIACÕES E SIGLAS

ANDE- Brasil	Associação Nacional de Equoterapia – Brasil
APAE	Associação de Pais e Amigos dos Excepcionais
ASD	Autism Spectrum Disorder
ASPEQ	Associação Paraibana de Equoterapia
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior
CONSORT	Consolidated Standards for Reporting Trials - checklist
CSTR	Centro de Saúde e Tecnologia Rural
DI	Deficiência Intelectual
DSM-V	Manual Diagnóstico e Estatístico de Transtornos Mentais
E	Equitherapy
EAAT	Equine Assisted Activity and Therapy
EADE	Equoterapia ou Atividade e Terapias Assistidas por Equídeos
EAI	Equine Assisted Intervention
EAOT	Equine-Assisted Occupational Therapy
EAT	Equine-Assisted Therapy
EPE	Psychoeducational Riding
EQUOPATOS	Centro de Equoterapia em Patos – PB
ET	Therapeutic Riding
HIP	Hippotherapy
IE	Riding Intervention
JCR	Journal Citation Reports (Fator de Impacto)
MT	Movimento Tridimensional
ONG	Organização Não Governamental
OMS	Organização Mundial de Saúde
PRISMA	Main Items for Reporting Systematic Reviews and Meta-analyses -
PROSPERO	International Prospective Register of Systematic Reviews
RE	Equestrian Rehabilitation
RSTUDIO	RStudio interface - version 1.1.463
SDHRP	Simulated Developmental Horse-Riding Program
SNC	Sistema Nervoso Central
TEA	Transtorno do Espectro do Autismo
THR	Passeios a Cavalos Terapêuticos / Equitação Terapêutica
UFMG	Universidade Federal de Campina Grande

## LISTA DE SÍMBOLOS

**	Número de Respostas
%	Porcentagem
<	Menor
$I^2$	Inconsistency
DP	Desvio Padrão
Md	Mediana
Me	Média
MeG	Média Geral
Mo	Moda

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## INTRODUÇÃO GERAL

O Transtorno do Espectro Autista (TEA) é considerado um transtorno comportamental e de desordem neurobiológica, cuja etiologia apresenta-se de forma multifatorial e o diagnóstico está associado aos comportamentos estereotipados repetitivos e alterações no funcionamento de duas ou mais áreas das habilidades adaptativas, como a comunicação e a interação social (SCHMITT, 2015).

De acordo com o Manual de Diagnóstico e Estatístico de Transtornos Mentais, há uma junção de vários transtornos neurológicos que compõem o TEA, dentre eles o Transtorno de Asperger, Transtorno Desintegrativo da Infância e o Transtorno Autista, que pode ser classificado em leve, moderado ou grave, de acordo com o grau de gravidade e o atraso no desenvolvimento, considerando o comportamento repetitivo, a dificuldade de comunicação e os interesses restritos ou manifestações clínicas que cada portador apresenta (SWEDO, 2014).

Independentemente da classificação do TEA, estima-se que há aproximadamente 70 milhões de pessoas com o TEA, sendo 2 milhões no Brasil. De acordo com o Center of Diseases Control and Prevention (CDC), órgão ligado ao governo dos Estados Unidos, entre os anos de 2000-2002 a prevalência era de uma em cada 150 crianças apresentavam o TEA, entre tanto esses valores aumentaram relativamente, sendo: 1 em cada 68 crianças durante 2010-2012, 1 em cada 59 crianças em 2014 e nos últimos dados referentes ao mês de março de 2020 alcançou-se 1 em cada 54 crianças, ou seja, a incidência do TEA/autismo está em crescente progresso em 12 anos, com aumento de quase 16% entre 2012 e 2014, e um pouco menos em um período de 6 anos até 2020 com 9%, tornando-se assim uma questão de saúde pública para os países e um desafio para os diferentes profissionais (MAENNER MJ et al., 2020).

Com relação às manifestações clínicas do TEA ocorrem nos três primeiros anos de vida, podendo levar a um retardo no processo do desenvolvimento psicomotor decorrente das complicações na socialização da criança, resultando na dificuldade do domínio da linguagem, movimentos estereotipados, utilização dos objetos de forma estereotipadas e/ou “ritualizados”, comportamento focalizado, ansiedade, dificuldade em relaxar, ausência de concentração, atrasos psicomotores e hipersensibilidade sensorial. Todas essas alterações abrangem a comunicação, a emoção, relacionamento social, contato visual e os interesses nas atividades, que constituem funções do sistema nervoso central e cognitivo (SCHMITT, 2015).

Para Gonçalves (2011) as crianças com TEA apresentam as mesmas habilidades cognitivas de crianças neurotípicas, só que em diferentes níveis de intensidade, sendo este um dos principais comprometimentos relatados pelos profissionais de saúde e educação. Quanto

a cognição está relacionada à capacidade de saber, ou seja, ao conjunto das funções de receber, guardar e tratar as informações que o indivíduo recebe, incluindo a aprendizagem, atenção, memória, julgamento ou compreensão, sendo assim, a cognição dos autistas é analisada através dos processos cognitivos, por meio de diferentes abordagens lúdicas e sociais (HOLANDA, 2013).

O tratamento precoce é apontado em inúmeros estudos como um fator fundamental no desenvolvimento do quadro clínico do TEA, pois na fase das manifestações clínicas há o pico de plasticidade neural, onde o tratamento se torna mais eficaz e obtêm-se resultados positivos (SOUZA, 2015). Sendo assim, devemos destacar a Equoterapia, que tem apresentado uma alta repercussão na reabilitação de várias patologias na atualidade, incluindo os indivíduos com Transtorno do Espectro Autista e/ou Deficiências intelectual – DI, que se refere a pessoas com quadro de inteligência e habilidades gerais da vida inferior à média com comprometimento nos comportamentos adaptativos, sociais e práticos (KWON et al., 2015).

De acordo com a Associação Nacional de Equoterapia - ANDE-BRASIL, a Equitação Terapêutica (THR) ou Equoterapia como é designada no Brasil, trata se de um método terapêutico interdisciplinar nas áreas de saúde, educação e equitação, cuja a finalidade é promover o desenvolvimento biopsicossocial e sensório-motor em pessoas com necessidades especiais e/ou portadoras de deficiências, através da utilização do cavalo como principal ferramenta cinesioterapêutica (ANDE, 1999).

Vale salientar que a Equoterapia passou a ter sua prática reconhecida como método de tratamento para pessoas com necessidades especiais em 1997, por meio do parecer de nº 06/97 pelo Conselho Federal de Medicina e somente em 2008 pelo Conselho Federal de Fisioterapia e Terapia Ocupacional (ALVES et al., 2009). Outro aspecto importante sobre a prática da Equoterapia está relacionado a Lei 13.830/2019, sancionada dia 13.05.2019 em que reafirma a utilização do cavalo para fins terapêuticos através de uma abordagem multiprofissional, constituída por uma equipe de apoio composta por médico e médico veterinário e uma equipe mínima de atendimento composta por psicólogo, fisioterapeuta e um profissional de equitação, podendo, de acordo com o objetivo do programa, ser integrada por outros profissionais, como pedagogo, fonoaudiólogo, terapeuta ocupacional e professores de educação física (BRASIL, 2019).

Segundo Kupske et al. (2015), a escolha dos equinos como instrumento terapêutico se dá em decorrência de algumas características específicas, como: o temperamento dócil, sensibilidade aos sons, tolerância ao toque, os movimentos, o físico do cavalo e outros, apesar de serem considerados animais de grande porte são favoráveis para este tipo de terapia. Além da

Simbiose Homem-Cavalo, que permite por meio da interação com o cavalo a busca por novos meios de comunicação e interação social, revelando expressões, sentimentos, sons e palavras, que propiciam o aumento das habilidades cognitivas e beneficiam o desenvolvimento da motricidade (SOUZA, 2015).

Desse modo, os benefícios proporcionados pela equoterapia estão intimamente ligados ao animal, ou seja, os movimentos realizados pelo cavalo denominado de “Movimento Tridimensional – MT”, que se assemelha a aproximadamente 95% ao movimento realizado pela pelve humana durante as fases da marcha. Sendo esse movimento decorrente do deslocar ao passo, marcha ou andadura do cavalo que realiza movimentos no plano vertical, ântero superior; plano frontal, ântero-posterior; látero lateral e no plano sagital; gerando assim uma rotação pélvica em torno de oito graus em ambos os lados. Além do biorritmo do cavalo que se aproxima ao do ser humano, como o ritmo e o balanço de forma simétrica e rítmica, que corresponde a 180 oscilações por minuto, possibilitando intervenções de aprendizagem capaz de estimular o sistema nervoso central (SNC), por meio de inputs sensório-motor que induzem o processamento sensorial e neuromotores adequados (BRANDÃO, 2014; CUERVO, 2017).

Desenvolvendo assim os mecanismos perceptivos e cognitivos, estimulando a sensibilidade tátil, visual, auditiva e olfativa pelo uso do cavalo e do ambiente. Dentre os objetivos dessa terapia estão os neuromotores globais, que auxiliam nos ajustes tônicos, no equilíbrio, na coordenação motora, alinhamento corporal, resistência, fortalecimento muscular e outros (THOMPSON, 2014; CHAMPAGNE, 2016).

Em decorrência desses aspectos a Equoterapia está sendo considerada como uma terapia única, capaz de interferir positivamente no desenvolvimento psicomotor e sensorial do praticante através de técnicas que proporcionam a facilitação da autonomia, independência e a integração social das crianças e dos familiares (MONTENEGRO, 2014; SOUZA, 2015).

Neste contexto, a compreensão sobre a Equoterapia e os seus efeitos nos praticantes, em especial as crianças com Transtorno do Espectro Autista e/ou Deficiência Intelectual, são fundamentais para o avanço, aceitação e desenvolvimento desse método terapêutico. Bem como na adoção de estratégias de intervenções e padronização das avaliações equoterapêuticas no TEA ou DI. Como também, abordagens multidisciplinares e divulgação dos resultados nas áreas das funções cognitivas dos praticantes com TEA e /ou DI, permitindo assim, o acesso à informação à sociedade sobre os efeitos da equoterapia no TEA e na DI.

Sendo assim, a presente dissertação é composta por dois capítulos. O Capítulo I, que trata-se de uma revisão sistemática da literatura sobre os efeitos cognitivos da equoterapia



em crianças com TEA, será submetido ao periódico Revista Cadernos de Saúde Pública (JCR 1.408, Qualis A2). E o Capítulo II que consiste em uma análise do perfil e dos efeitos cognitivos em crianças com TEA e DI praticantes de equoterapia no estado da Paraíba, no qual será submetido ao periódico Research in Developmental Disabilities (JCR 3.230, Qualis A2).

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**CAPÍTULO I:**

**Benefits of equine therapies on the cognitive of children with Autism Spectrum  
Disorder: systematic review and meta-analysis**

Natália Soares Oliveira; Sérgio Santos de Azevedo  
Artigo a ser submetido à Revista Cadernos de Saúde Pública  
(JCR 1.408, Qualis A2)

**Title in Português:**

Benefícios das terapias com equinos no cognitivo de crianças com Transtorno do Espectro Autista: revisão sistemática e meta-análise

**Title in English:**

Benefits of equine therapies on the cognitive of children with Autism Spectrum Disorder: systematic review and meta-analysis

**Title in Spanish:**

Beneficios de las terapias equinas en el cognitivo de los niños con trastorno del espectro autista: revisión sistemática y metanálisis

**Title in Short:**

Equine therapies: systematic review and meta-analysis

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**Resumo**

O Transtorno do Espectro do Autismo (TEA) é um transtorno do neurodesenvolvimento, cujo a etiologia apresenta-se como multifatorial e os sinais/sintomas antecedem os três anos de vida, tendo como principal característica o comprometimento das áreas cognitivas e o déficit social. O objetivo deste trabalho foi descrever os benefícios das atividades e terapias com equinos nas

áreas cognitivas de crianças com TEA/autismo. Sendo realizado por meio de uma revisão sistemática com meta-análise de artigos científicos indexados em bases de dados online (BVS Salud, Periódicos CAPES, PubMed, Science.Gov, Scielo, REDALYC, e a plataforma da ANDE Brasil). A inclusão dos artigos na revisão sistemática foi efetuada conforme a *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) e a qualidade avaliada pelos Padrões Consolidados para Relatar Ensaaios - *checklist* CONSORT. Ao todo foram incluídos 29 estudos, totalizando 591 participantes com prevalência do gênero masculino em 78% para 22% feminino com idades entre 5 e 11 anos, participantes de terapias assistidas por equinos. Os métodos utilizados nas intervenções e avaliações diferiram entre os artigos, entretanto foi possível identificar respostas positivas nas áreas cognitivas, principalmente no que diz respeito ao cognitivo social e emocional. De acordo com os estudos analisados estas respostas cognitivas ocorrem devido ao movimento realizado pelo cavalo, os estímulos transmitidos e o ambiente. Conclui-se que as atividades e terapias com equinos promovem benefícios e o desenvolvimento cognitivo em crianças com TEA/autismo.

**Palavras chave:** Autismo; Cognição; Equitação Terapêutica.

### **Abstract**

The Autistic Spectrum Disorder (ASD) is a neurodevelopmental disorder of multifactorial etiology and the signs/symptoms precede the three years of life, having as main characteristic the impairment of cognitive areas and social deficit. The aim of this article was to describe the benefits of equine activities and therapies in the cognitive areas of children with ASD / autism. It was carried out through a systematic review with meta-analysis of scientific articles indexed in online databases (BVS Salud, CAPES Periodicals, PubMed, Science.Gov, Scielo, REDALYC and ANDE Brasil platform). The inclusion of articles in the systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) and the quality assessed by the Consolidated Standards for Reporting Trials - CONSORT checklist. Twenty-nine studies were included, totaling 591 participants with a male prevalence of 78% to 22% of females aged between 5 and 11 years, participating in equine-assisted therapies. The methods used in the interventions and assessments differed between the articles, but it was possible to identify positive responses in the cognitive areas, especially with regard to cognitive social and emotional. According to the studies analyzed, these cognitive responses occur due to the movement performed by the horse, the transmitted stimuli and the environment. It is concluded that activities and therapies with horses promote benefits and cognitive development in children with ASD / autism.

**Key words:** Autism; Cognition; Therapeutic Riding.

## Resumen

El Trastorno del Espectro Autista (TEA) es un trastorno del neurodesarrollo, cuya etiología es multifactorial y los signos / síntomas preceden a los tres años de vida, teniendo como característica principal el deterioro de las áreas cognitivas y el déficit social. El objetivo de este artículo fue describir los beneficios de las actividades y terapias equinas en las áreas cognitivas de los niños con TEA / autismo. Se realizó mediante una revisión sistemática con metaanálisis de artículos científicos indexados en bases de datos en línea (BVS Salud, CAPES Periodicals, PubMed, Science.Gov, Scielo, REDALYC y la plataforma ANDE Brasil). La inclusión de artículos en la revisión sistemática se realizó de acuerdo con los ítems de reporte preferidos para revisiones sistemáticas y metaanálisis (PRISMA) y la calidad evaluada por los estándares consolidados para reportar ensayos - lista de verificación CONSORT. Se incluyeron un total de 29 estudios, con un total de 591 participantes con una prevalencia de hombres de 78% a 22% de mujeres, con edades entre 5 y 11 años, que participaron en terapias asistidas por equinos. Los métodos utilizados en las intervenciones y evaluaciones difirieron entre los artículos, sin embargo fue posible identificar respuestas positivas en las áreas cognitivas, especialmente en lo que se refiere al cognitivo social y emocional. Según los estudios analizados, estas respuestas cognitivas se producen debido al movimiento que realiza el caballo, los estímulos transmitidos y el entorno. Se concluye que las actividades y terapias con caballos promueven los beneficios y el desarrollo cognitivo en niños con TEA / autismo.

**Palabras llave:** Autismo; Cognición; Equitación terapéutica.

## Contributors

N.S. Oliveira and S.S. Azevedo participated in all phases of the study, from preparation, planning, analysis, data interpretation, article writing and critical review of the content. The approval of the final version of the work was also carried out by S.S. Azevedo.

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## Conflict of interests

The authors declare no conflicts of interest.

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## **Introduction**

Autism Spectrum Disorder (ASD) is a neurodevelopmental and neurobiological disorder, whose diagnosis is associated with stereotyped repetitive behaviors and changes in the functioning of two or more areas of adaptive skills, such as communication and social interaction. In addition, ASD has multifactorial etiology, and depending on the severity and developmental delay, it can be classified as mild, moderate or severe.<sup>1</sup>

The clinical manifestations of ASD start in the first three years of a child's life and are constantly related to the difficulties or absence of communication, language development, behavioral changes and social interaction, in addition to changes in cognitive areas.<sup>2</sup> In order to promote quality of life and the development of global skills of people with ASD, new therapies and complementary methods have been emerged in this context, especially equine-assisted therapies.<sup>3</sup>

The activities and therapies with horses receive different terminologies. In Brazil they are designated as Riding Therapy or Equine Assisted Therapy (EAT) which comprise an interdisciplinary therapeutic method in the areas of health, education and horse riding, whose objective is to promote biopsychosocial and sensorimotor development in people with special needs and/or people with disabilities.<sup>4,5</sup>

Regardless of the nomenclature, horses are used as the main kinesio therapeutic tool, as they perform a three-dimensional movement that resembles the movement of the human pelvis during the phases of gait. In addition to allowing human/animal contact and different stimuli throughout the sessions, in order to provide improvements in muscle tone, posture, coordination, balance, sensitivity and cognition.<sup>2</sup>

These and other benefits of EAT are reported in numerous studies, however, evidence for a clear association between the benefits of EAT in cognitive areas in ASD is presented in a



relatively smaller number of researches. They are most often approached indirectly, that is, as a complementary result or in comparative studies between ASD and other pathologies. Therefore, this systematic review with meta-analysis aimed to investigate and analyze, through published studies, the benefits of EAT on the cognitive areas of children with ASD.

## **Methodology**

### **Identification and search strategy for studies**

This is a systematic review with meta-analysis study, registered in the International Prospective Register of Systematic Reviews PROSPERO, in accordance with the Preferred Reporting Item Guidelines for Systematic Reviews and Meta-Analyses (PRISMA).<sup>6</sup>

Thus, the following online databases were used: BVS Salud, CAPES Periodicals, PubMed, Science.Gov and SCIELO, in addition to the website of the National Association of Riding Therapy (ANDE), Brasil, and the REDALYC platform, for the inclusion of additional studies. There was no delimitation of the period of publication of the articles due to the search/search differences between the databases.

To enable the analyzes and increase the probability of locating the published studies, descriptors selected after consulting the Descriptors in Health Sciences, Bireme (DeCS) were used. The search was conducted using concepts grouped into two blocks: the first with terms related to equine-assisted therapy ("equine assisted therapy", "hippotherapy", "riding therapy") and the second with terms associated with ASD ("autism", "autism spectrum disorder", "autistic spectrum"). To combine these descriptors, the logical operator "OR" was used within each block and the logical operator "AND" to combine blocks in the databases. With the exception of the ANDE-Brasil and REDALYC platforms, the simple search process was used, using only the terms: "Hiding Therapy" and "Autism". The systematic literature searches ended in March 2021, where the data obtained were part of a virtual library at MENDELEY, which allowed the organization, management of references and data for the screening process.

### **Eligibility criteria**

Articles that reported the benefits of EAT directly or indirectly in at least one of the areas related to cognitive impairment in children with ASD/autism were included. However, articles were excluded when presented similar data and methodologies with the same type of

sample and that had been published later, with the exception of the most recent studies; studies with a population composed of a pathology other than ASD or autism; non-pediatric population; period of completion of treatment with EAT not defined; incomplete articles and studies with inconsistently described variables. There were no restrictions regarding language, year of publication of the study, gender, degree of ASD, number of study samples and techniques used in the EAT.

### **Methodological quality assessment**

Methodological quality was assessed by the authors using Consolidated Standards for Reporting Trials - *checklist* CONSORT. Thus, all clinical trials included in this research were analyzed according to the following quality criteria: justification for carrying out the study; description of specific objectives and hypotheses; participant eligibility criteria; description of the intervention; description of primary and secondary outcomes; justification of sample size; detailing of masking and randomization procedures.<sup>7</sup>

### **Extraction Data**

Categories attributed to the outcomes were used to designate the benefits in the cognitive areas, namely: social cognitive (social motivation, social interaction and social skills), communication (language and verbalization), behavior (personality, engagement, self-determination, self-care and interpersonal relationships), attention (orientation and memory), processing (visual, auditory and planning), emotion and empathy (affective social).

For data extraction, a customized database was developed in the *Software Microsoft Office Excel 2019* with fields referring to the identification characteristics of the studies, clinical characteristics of the participants, type of study and methodology, therapeutic measures, outcomes observed in the cognitive areas and in the rehabilitation in general. Data were assigned to tools such as pivot tables, generation of graphs and spreadsheets in Excel.

### **Statistical analysis of data**

The analysis of selected articles was carried out descriptively and in two stages. The first related to the year, authorship, study site, type of study, population characteristics, methodological design, intervention characteristics, outcome assessment and study results. The

second stage comprised the statistical analysis of the data according to the intervention protocol adopted during the study and when there was a presence of data, there was also an analysis by intention to rehabilitate the children who were assigned at the beginning of the studies in intervention groups or control.

A *Forest-Plot* graph was used to present the results of the meta-analysis and comparison of the studies, carried out through the R environment (R CORE TEAM, 2019), RStudio interface (version 1.1.463). For quantitative data, a confidence interval of 95% (95% CI) was considered. Heterogeneity between the findings of the studies was measured by the Cochran Q test (Q test) with assumed significance at  $p < 0.05$ . Another way to assess heterogeneity between studies was through inconsistency ( $I^2$ ), which specifies the percentage of variation between studies giving heterogeneity. The values of  $I^2$  range from 0-100%, where it was assumed that the value corresponding to 0% was indicative of non-heterogeneity and values above 50% of substantial heterogeneity.

## **Results**

### **Description of studies**

Initially, 1.496 studies were identified in the searched databases, with the removal of 107 duplicates and the elimination of 1.271 articles after the screening process of the title and abstract reading, resulting in 118 articles eligible for full text reading. Eighty-nine papers excluded after reading, and 29 articles were considered eligible for systematic review (Figure 1).

Although the 29 articles did not exclusively include randomized controlled trials of ASD, seventeen cohort studies were aligned within <sup>2,4,5,8-22</sup> randomized clinical trials on the benefits of equine-assisted therapy intervention in ASD / autism. There were four cases studies, <sup>3,23,24,25</sup> four control cases, <sup>1,26,27,28</sup> two comparative studies <sup>29,30</sup> and a single exploratory study.<sup>31</sup> Most researches were carried out between the years 2015 and 2020. Twenty-four articles were published in English, three in Portuguese and two in Spanish.

### **Assessment of the methodological quality of studies**

In the methodological evaluation of the studies, only six criteria from the *checklist* CONSORT<sup>7</sup> were not widely met. Among them, the description of the professional's

flowchart, the age group of the studied population and the clarity regarding the absent hypothesis in a study.<sup>19</sup> In general, the randomization and masking process were adequate taking into account the methodological delimitation of the studies, however, in nine articles<sup>3,4,6,7,8,14,19,27,28</sup> there were not description if the allocation sequence was kept confidential until the intervention. Data on the description of the sample size, reporting of the “recruitment” date and the dates of the follow-up period were present in all studies. In two articles there was no description of the clinical characteristics of the studied participants.<sup>11,19</sup> In only one study, therapy was performed using a simulator of the Simulated Developmental Horse-Riding Program (SDHRP), type as the main therapeutic tool.<sup>17</sup> In general, most studies were considered as “strong” and “moderate”.

### **Characteristics of samples and studies**

Regarding the sampling process, there was great variability in the composition of the sample between genders. Being the sample consisted of 591 children diagnosed or classified with ASD and autism who participated in the selected studies, of these approximately 77% are male and only 22% female. The sample size also diverged between the studies, with the smallest sample consisting of three children and the largest of 116 children, with the exception of case studies carried out with a single child. Despite the variability between the sample number and aspects related to the classification of ASD (mild, moderate and/or severe) present in the samples, there was no divergence between the cognitive results and the practice of EAT.

The age group among the research participants was from five to 11 years old, where practically all were followed before, during and after some periods of intervention with horses, with the exception of one study<sup>3</sup> that carried out the assessment at the beginning and at the end of five sessions and two studies<sup>19,29</sup> that took place through reports from guardians and/or professionals working in therapy centers.

All children included in the studies participated in equine-assisted interventions, however equine-assisted therapy had different nomenclatures resulting from the location and intended purpose, such as: Occupational Therapy Assisted by Horses, Therapeutic Riding Program, Hippotherapy, Therapeutic Riding, Equestrian Rehabilitation and Intervention through Horse Riding. As well as the nomenclature, other topics also presented variations, such as the intervention period, evaluations and the number of sessions, however, the selected studies demonstrated as a common objective the rehabilitation in the psychomotor and biopsychosocial areas. The characteristics of the studies are shown in Table 1.

## Overview of interventions and cognitive responses

As the interventions were carried out in different therapeutic centers, there was a variability between the duration of the sessions and the interventions. Thus, any type of therapy with horses, including the use of an equestrian simulator, was considered a horse-assisted intervention.

The research by Wuang et al<sup>23</sup> was the only one carried out using a simulator, the SDHRP, in which the research was carried out over a period of 44 weeks subdivided into 20 weeks of 45 minutes of intervention with the simulator of equine movements. The other studies used the horse as a therapeutic tool with durability between 30 and 60 minutes in weekly sessions, with the exception of two studies whose sessions took place between 90 and 180 minutes.<sup>3,16</sup>

The most prevalent interventions among the studies were therapeutic riding performed over a period of approximately ten weeks in almost all studies, and equine-assisted therapy present in seven studies.<sup>3,8, 12,13,18,19,30</sup> Other interventions were associated with riding activities and equestrian rehabilitation, including muscle relaxation techniques, stretching, postural alignment, transfers and balance, as well as sensory and social integration activities in children with ASD.

Regarding the benefits in the cognitive areas, they were measured indirectly, that is, based on the information and reports identified by the authors. In all articles included in this review, the benefits were described as positive results, using scales, tests and assessments before and after interventions that ranged from motor development to social integration. Although most studies have used assessments and scales to assess equestrian interventions, it is noteworthy that 25 studies were carried out through the reports of professionals and/or guardians of the children, who reported advances and progress in cognitive aspects.

Of these, twenty-three described social interaction as one of the main cognitive benefits of EAT to children and adolescents with ASD. Other aspects that make up the cognitive areas identified in the analyzed studies were: improvement in behavior present in 15 studies; development of language and communication skills evident in 15 surveys; affective social involving empathy and emotions detailed in 11 articles; auditory/visual and attention processing in four and three studies, respectively (Complementary material).

## Quantitative analysis

The number of studies that included measures of statistical effects was relatively smaller compared to those that described descriptive data. Thus, there are differences in the data analysis, however, nine studies were included to carry out the meta-analysis.

The meta-analysis revealed statistical significance ( $p = 0.01$ ) between the summarized scores and the rating scales used in children with ASD/autism participating in equine-assisted activities and therapies. As well as the prevalence of males in the intervention and control groups (Figure 2). Considerable heterogeneity was observed in the analysis of  $I^2$ , being considered substantial in 58%.

## Discussion

The results of the present study corroborates with the researches carried out involving the social and cognitive development of children with ASD/autism who participate in programs and activities with horses, especially when compared with children who participate in non-equine programs called control groups that may present results, but are to a lesser degree in relation to the groups of activities with horses, as shown in Figure 2 through the data obtained in the evaluations and scores used in the samples of the intervention and control groups, which showed a predominance of males gender in the samples of the analyzed studies, thus reinforcing the perception of Petty et al<sup>27</sup> who associate this fact to the large gender discrepancy in the general population with ASD being male, thus influencing the results of sample analysis in research with ASD/autism.

There is also a high incidence of children and young adults with ASD in health centers and entities focused on rehabilitation, thus, ASD/autism is considered a public health issue in view of the impacts on health networks and centers of EAT. It is worth mentioning that EATs act as facilitators in several areas of health and education, as it has been observed that they are able to reduce anxiety, aggression, irritability, stereotypes and others. In addition to increasing the concentration and attention of individuals with ASD, especially when related to the cognitive domains, in which they present significant improvements in the emotional, behavioral and social cognitive domains, as described by Petty et al<sup>27</sup> when analyzing the relationship between children with ASD and animal's pets through hippotherapy.

Other authors such as Harris<sup>1</sup> and Zoccante et al<sup>20</sup> also stated that activities involving horses have been beneficial in sensory and behavioral functions, especially in reducing

aggression. The studies mentioned above confirm the results of the research carried out by Garcia-Gomez et al<sup>21</sup>, which identified a reduction in aggressive behavior and hyperactivity in children with ASD/autism after therapeutic riding sessions.

These aspects are part of the areas of behavior that represent a challenge for those responsible, the health system and health professionals. The general behavior of children with ASD has shown promising results in approximately 15 studies<sup>4,5,11,13,15,16,20-23,25,26,27,29</sup> analyzed by this review. In particular the research developed by Leitão<sup>31</sup> which analyzed the benefits of psychoeducational riding in children with autism, the analysis consisted of specific points of neuropsychomotor development including behavioral and cognitive analyses, which resulted in cognitive, behavioral and emotional advances (social, affective and empathic), in addition to balance and physical functioning.

Regarding cognitive emotional, other 11 authors<sup>3,9,11,12,18,21,26-29,31</sup> identified progressive improvements in social emotions, associated with the feeling of empathy and engagement. According to Anderson et al<sup>16</sup> and Malcolm et al<sup>19</sup>, equine-assisted therapy provides children with a version of empathy that is restricted to specific types of humans, that is, empathy occurs as a response to sensory experiences and interactions developed through contact with the horse, which is considered a facilitator of the emergence of social behaviors.

Thus, confirming the results identified in 23 studies<sup>1,3,4,5,8,9,10-13,17-23,25-30</sup> about the positive effects on social cognitive. Mainly in social interaction and in the development of social skills of children with ASD and autism, which despite the high variability of interventions at the end showed similar descriptive results in relation to the social evolution of children. Furthermore, what is related to social cognitive is associated with the level of interaction with peers and the language presented by children after therapy with horses, as mentioned by Steen et al.<sup>3</sup>

Therefore, the improvement in verbal and non-verbal language skills was described by 15 authors<sup>3,5,9,12,15,18,19,21-24,26,28,29,31</sup> as important evidence of the benefits of therapy with horses in the areas of communication in the ASD, thus affirming that there are developments in language, communication, sensory awareness, physical and behavioral health, cognition and socialization. Other authors presented similar findings,<sup>5,16,30</sup> although the studies interventions took place at different periods.

All of these benefits pointed out in the cognitive areas do not eliminate the need to continue conducting new research associated with horse-assisted activities and therapies in children with ASD. The challenge in carrying out this analysis and meta-analysis is highlighted by the lack of a standardized approach in interventions involving horses and children with ASD, despite the existence of different scales, assessments and instruments used in research published in recent years.

## Conclusion

This review confirms the benefits of horse-assisted activities and therapies in the cognitive areas of children with ASD and autism, principally with regard to social and emotional cognitive. Another area with significant results was related to the behavior of children who showed reduced irritability, hyperactivity and aggressiveness when participating in hippotherapy, despite the variability of protocols and intervention periods.

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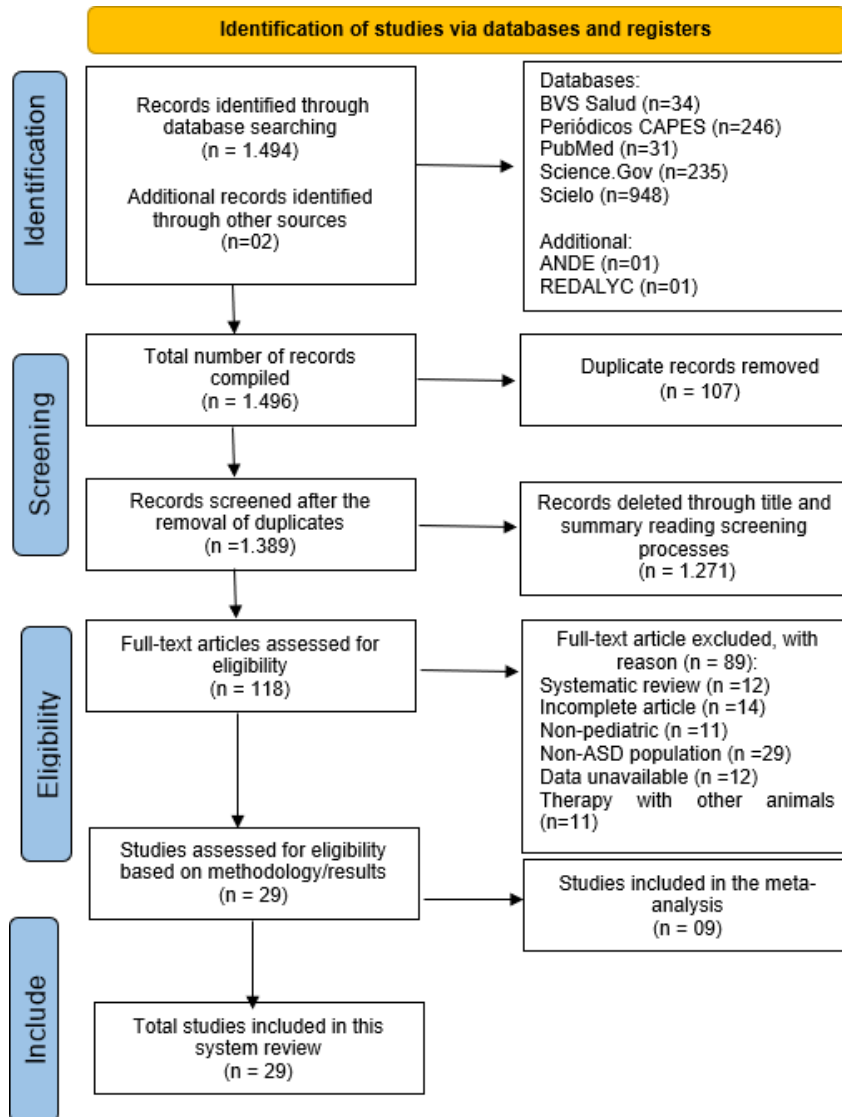


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**FIGURE 1:** Flowchart of studies from the systematic review and meta-analysis (PRISMA) that describes the studies identified, included and excluded with justification.

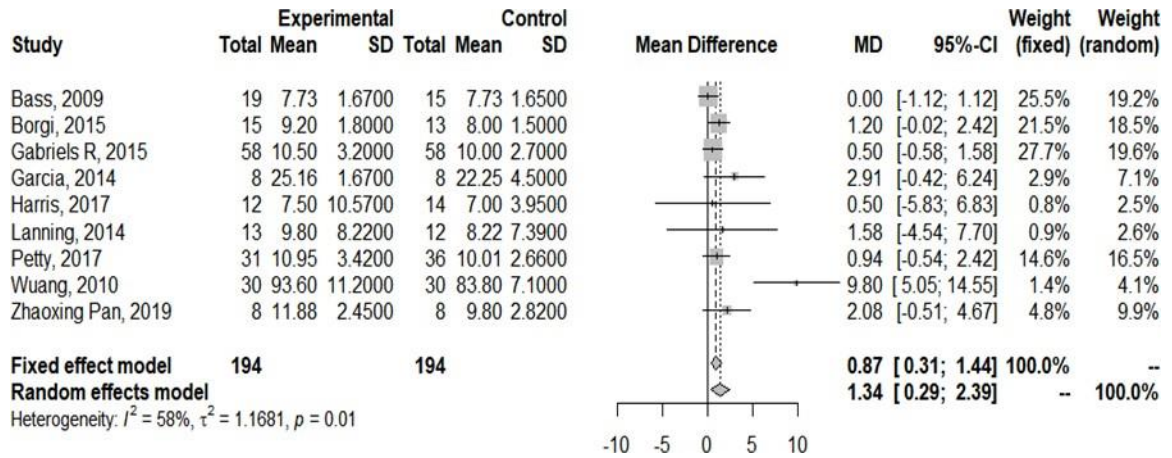


**TABLE 1:** Characteristics of the articles included in the review.

Reference	Local	Diagnosis	Sample	Gender Male (%)	Sample Age Mean	Type of Therapy
Aaron, 2013	USA	ASD	7	55	4	HIP
Ajzenman H, 2013	USA	ASD	6	70	8.5	HIP
Anderson, 2016	UK	ASD	15	74	10.5	THR
Barbosa, 2019	Brazil	ASD	3	100	6.5	E
Bass, 2009	Florida	Autism	34	85	7	ET
Borgi, 2015	Italy	ASD	28	100	9	EAT
Cerino, 2016	Pomegranate	ASD	1	100	8	RE
Fernandez, 2015	Cuba	ASD	10	50	6	E
Freire, 2015	Brazil	Autism	7	71	6.5	TE
Gabriels R, 2015	Colorado	ASD	116	86.5	11	THR
Garcia, 2014	Spain	ASD	16	79	10.5	ET
H Steiner, 2015	Budapest	Autism	26	46	11.5	THR
Harris, 2017	UK	ASD	26	85	7.5	IE
Holm, 2014	USA	ASD	3	100	7	TE
Kern J, 2011	USA	ASD	24	75	7.5	EAT
Lanning, 2014	USA	ASD	25	80	9.5	EAT
Piglet, 2004	Lisbon	Autism	5	80	7.5	EPE
Llambias, 2016	USA	ASD	7	60	6	EAT
Malcolm, 2018	UK	ASD	10	60	7	EAT
Memishevijkj, 2010	Saravajo	ASD	4	50	9	EAT
Peters, 2020	USA	Autism	6	85	9.5	EAOT
Petty, 2017	USA	ASD/Asperger	67	90	11	THR
Potvin, 2021	Quebec	ASD/Autism	26	54	7	EAT
Steen, 2019	Netherlands	ASD	1	-	8	EAT
Tan, 2017	Australia	ASD	6	20	8.5	EAI
Ward S, 2013	Virginia	Autism	21	70	7	TE
Wuang, 2010	Taiwan	Autism	60	78.5	7	SDHRP
Zhaoxing Pan, 2019	California	ASD	16	80	11	THR
Zoccante, 2021	Italy	ASD	15	85	11	EAAT

ASD: Autism Spectrum Disorder; Gender Male (%): Percentage of the male sample present in the study; THR/TE: Therapeutic Riding; EAT: Equine Assisted Therapy; EAI: Equine Assisted Intervention; IE: Riding Intervention; RE: Equestrian Rehabilitation; EPE: Psychoeducational Riding; EAOT: Equine-Assisted Occupational Therapy; HIP: Hippotherapy; SDHRP: Simulated Developmental Horse-Riding Program; E: Equitherapy; EAAT: Equine Assisted Activity and Therapy; ET: Therapeutic Riding.

**FIGURE 2:** Forest-plot of intervention and control groups in children with ASD / autism participating in equine-assisted activities and therapies.



Material Complementary - Table 2

**TABLE 2:** Description of participants, primary outcome measure, interventions and results found in the included studies.

Reference	Study Design	Participants	Primary Outcome	Intervention	Results
Aaron, 2013	Application of the Autism Treatment Assessment Checklist Search (ATEC), before and after therapy with horses.	Total: 7 children, Diagnosis: ASD, Age range: 2 – 6 years old, Gender: 04 men and 03 women.	Improved functioningphysicist.	Protocol: Sessions of 30 to 45 minutes with an intervention period between 6 months to 1 year and a 36otó. Activities: Verbal command, motor coordination, sensory stimulation and others.	ATEC score reduction in all participants. And improvement in social cognitive, behavioral, sensory, communication and physical functioning .
Ajzenman H, 2013	Application of the Vineland Adaptive Behavior Scales – II and the Child Classification of activitycards, before and after Hippotherapy.	Total: 6 children, Diagnosis: ASD, Age range: 5 - 12 years old, Gender: 04 men and 02 women.	Decrease in postural 36otó.	Protocol: 12 Hippotherapy sessions, lasting 45 minutes. Activities: Exercises and functional positions on the horse, cones, games with figures, balls and others.	Significant effects on controlpostural and adaptive. Besides the improvement in behavior, socialization, social cognitive, self-care, mobility and others.
Anderson, 2016	Application of the Vineland Adaptive Behavior Scale (VABS).	Total: 15 children, Diagnosis: ASD, Rangeage: 5 - 16 years old, Gender: 11 men and 04 women.	Improvement in aspects of social functioning.	Protocol: 5 sessions lasting 3 hours each 36otó36c session. Activities: Assessments, 36otó36c activities, relaxation exercises, instructor-led equine activities.	Participants showed improvements in social functioning, communication and behavior. Other positive responses were related to, empathy and reduced ASD traits.
Barbosa, 2019	Type AB single-subject design method. Application of the Assessment of Basic Learning Abilities – ABLA, Anamnesis and Field Diary.	Total: 3 children, Diagnosis: ASD, Rangeage: 4-9 years old, Sex: 03 men.	Improvement in postural learning processes.	Protocol: 31 sessions lasting 4 months, twice a week. Activities: Postural exercises, activities with verbal commands, activities with visual and physical aid associated with the verbal.	All participants were able perform the postures with exclusively verbal assistance. Thus demonstrating positive responses in visual and auditory processing, in addition to procedural attention.
Bass, 2009	Application of the Social Response Scale (SRS) and Sensorial Profile (SP) before and after the intervention, in the intervention (n = 19) and control (n = 15) groups.	Total: 34 children, Diagnosis: ASD and Autism, Age range: 4- 10 years old, Gender: 29 men and 05 women.	Improved functioningSocial.	Protocol: 12 sessions lasting 60 minutes. Activities: Assembly and disassembly, warm-up for stretching, verbal command activities, coordination and riding exercises. Control group: Waiting list.	Significant improvements in sensory integration, reduction of inattention and distractions. In addition to improvements in social cognitive, communication, behavior and motivation. The control group was not as significant as the intervention group.

Borgi, 2015	The assessment was performed using the Vineland Adaptive Behavior Scale (VABS), pre and post intervention in the intervention (n=15) and control (n=13) groups.	Total: 28 children, Diagnosis: ASD, Range: 6-12 years old, Sex: 28 men.	Improved active and adaptive functioning.	Protocol: 25 sessions of 60-70 minutes, for 6 months. Activities: Preparation on the ground, walking, riding and closing in the ground, activities with visual aids, activities on the horse. Control group: Waiting list.	Improvements in social functioning and motor skills. As well as, reduction in the planning time of solutions for certain problem activities, when compared to the control group.
Cerino, 2016	Report of a case study involving a high-functioning child in a program Assisted by Equines.	Total: 1 child, Diagnosis: ASD, Age range: 8 years old, Sex: 01 man.	Improved cognition, communication and understanding.	Protocol: Weekly sessions of 60 minutes for 2 years. Activities: Stretching / preparation, horseback riding, walking.	Significant improvements in social cognitive, behavior, communication, social interaction, gradual reduction in imaginary attitudes.
Fernandez, 2015	Case study. Evaluation used: Horse-Assisted Psychotherapy Test by Aubrey H. Fine, before and after the interventions.	Total: 10 children, Diagnosis: ASD, Age range: 5-7 years old, Gender: 05 men and 05 women.	Increased capacity for initiative and communication.	Protocol: 2 sessions per week of 60 minutes for 1 year. Activities: Attention activity and games, facial expressions, exercises with figures and details.	Hippotherapy proved to be an effective therapy in the areas of communication, procedural, social, emotional care and rehabilitation of children with ASD.
Freire, 2015	Case study. Using the behavior observation and evaluation record sheets.	Total: 7 children, Diagnosis: Autism, Age range: 4-9 years old, Gender: 05 men and 02 women.	Improved behavior and motor skills.	Protocol: Weekly sessions of 30 minutes, for 1 year. Activities: Games, mimes, activities in pairs; exercises with verbal commands, gestures and posture exercises.	Significant changes in the development of motor skills and postural tonic adjustments. In addition to improvements in social cognitive, behavior, cognition and sensory areas.
Gabriels R, 2015	Evaluative intervention with intervention (n=58) and control (n=58) groups.	Total: 116 children, Diagnosis: ASD, Age range: 6-16 years old, Gender: 101 men and 15 women.	Improved adaptive and motor behaviors.	Protocol: 10 weeks of 45 minutes. Activities: Heating, assembly, handling, riding, riding exercises with images and relaxation. Control Group: Activities in the barn.	Improved behavior, reduced irritability and hyperactivity. In addition to positive responses in social cognitive, communication, motor coordination and sensitivity, when compared to the control group.
Garcia, 2014	Application of "Evaluation System of the Child behavior" (BASC) and Quality of Life Questionnaire in the experimental (n=08) and	Total: 16 children, Diagnosis: ASD, Age group: 7-14 years old, Gender: 13 men and 03 women.	Improvement in quality of life.	Protocol: 24 sessions of 45 minutes, twice a week for 3 months. Activities: Preparation, riding, exercises on the horse, riding, dismounting, farewell exercise.	The results showed significant differences in quality of life indicators. In addition to improvements in communication, social cognitive, procedural attention, reduced levels of



	control (n=08) groups.		Control Group: Evaluations.	hyperactivity and behavior.	
H Steiner, 2015	AnalyzePedagogical and Curriculum, gait test, Ariel Performance Analysis System videos, in the intervention (n = 13) and control (n = 13) groups.	Total: 26 children, Diagnosis: Autism, Age range: 10-13 years old, Gender: 12 men and 14 women	Improved coordination through correct movements and gait after the intervention.	Protocol: Weekly sessions of 30 minutes, for 1 month. Activities: Warming up, stretching with the horse and riding. Control Group: Pedagogical sessions without equine intervention.	There were differences in the duration of the gait cycle, becoming more stable in the sagittal plane, when compared to before therapy. In addition to positive responses in social cognitive, balance and motor coordination.
Harris, 2017	The evaluations used were: Childhood Autism Rating Scale and Behavior Checklist-Community, in the intervention (n=12) and control (n=14) groups.	Total: 26 children, Diagnosis: ASD, Age group:6-9 years, Gender: 22 men and 04 women.	Improved behavior of children with ASD during and after intervention with horseback riding.	Protocol: 12 sessions of 45 minutes, for 7 weeks. Activities: Preparation, riding, stretching and exercises with verbal commands. Control Group: Evaluations.	Significant reduction in the severity of ASD symptoms and hyperactivity in the pre- and post-test of the intervention group. In addition to the improvement in cognitive development and social functioning.
Holm, 2014	ABA Single Subject Studyexploratory type,through case reports.	Total: 3 children, Diagnosis: ASD, Age group:6-8 years, Sex: 03 men.	behavior improvement.	Protocol: Weekly sessions of 30-45 minutes, for 12 weeks. Activities: Horseback riding with physical exercises; activities involving emotion, behavior and cognition.	Improvement in behavior of approximately 70% during the intervention and 63% in the draw phase. In addition to improvements in functioning and cognition.
Kern J, 2011	The evaluations used were: Childhood Autism Rating Scale-CARS and Timberlawn Parent-Child Interaction Scale.	Total: 24 children, Diagnosis: ASD, Age group:3-12 years old, Gender: 18 men and 06 women.	Improved processing sensory and quality of life.	Protocol: Weekly sessions during6 months. Activities: Waiting period and horseback riding. 24 children took part in the waiting list and started riding.	Reduction in the severity of autism symptoms, especially in social cognitive, emotional and interpersonal relationships, resulting in improved quality of life.
Lanning, 2014	Pediatric Quality of Life 4.0 Generic Core Scales, Health Related Quality of Life and Child Health Questionnaire, in the intervention (n=13) and control (n=12) groups.	Total: 25 children, Diagnosis: ASD, Age group:4-15 years, Gender: 20 men and 05 women.	positive answersin behavior.	Protocol: Weekly 60-minute sessions for 12 weeks. Activities: Horse riding, behavioral skills activities and horse handling. Control Group: Educational and recreational activities.	Improvements in communication skills and concentration in performing tasks, social cognitive, affective, emotional, motor coordination, sensitivity and physical functioning.

Leitão, 2004	The evaluations used were: Development Scale and Behavior Scale	Total: 5 children, Diagnosis: Autism, Age range: 5-10 years old, Sex: 04 men and 01 woman.	Development motor coordination and general cognitive skills.	Protocol: 73 sessions weekly for 16 weeks. Activities: Adaptation and Backriding, level I and level II with more complex and longer activities.	The results were directed to advances and improvements in behavior, balance, communication, affective social, cognitive and physical functioning.
Llambias, 2016	The information was obtained through thereports from specialized education programs or services.	Total: 7 children, Diagnosis: ASD, Age group: 4-8 years, Gender: 04 men and 03 women.	Improvements in engagement activities.	Protocol: Sessions 45-60 minutes for 2 months. Activities: Coordination activities, cognitive exercises, occupation activities with the horse and imitation.	Gradual increase in engagement, improvements in auditory processing, social cognitive and children's personality.
Malcolm, 2018	report the researcher's experiences and interviews with parents, teachers, and therapy center staff.	Total: 10 children, Diagnosis: ASD, Age group: 4-10 years, Gender: 06 men and 04 women.	Improved development and cognitive aspects.	Protocol: 3 months of observation by the researcher, interviews and transcription of recorded interviews. There was no specification of sessions.	It identified an increase in social cognitive, communication, emotion, visual processing, sensitivity and physical functioning during and after the intervention.
Memishevijk, 2010	used the Autism Treatment Assessment Checklist (ATEC) in pre- and post-intervention assessments.	Total: 4 children, Diagnosis: ASD, Age group: 8-10 years, Gender: 02 men and 02 women.	Improved skills speech and general health.	Protocol: Weekly sessions 30 minutes for 10 weeks. Activities: Horse riding, guide, riding, riding in the arena, psychotherapy and ground activities.	It showed improvements in the domains of language / communication, social interaction, behavior, sensory, cognitive awareness and general health.
Peters, 2020	The evaluations used were: Canadian Occupational Performance Measure, Autism Diagnosis Observation Schedule and the Adaptive Behavior Assessment System.	Total: 6 children, Diagnosis: Autism, Age range: 6-13 years old, Sex: 05 men and 01 woman.	Improvement in occupational performance and social functioning.	Protocol: Sessions divided into 2 phases: without treatment and with equine therapy. Activities: Screening, evaluation, intervention with equine occupational therapy protocol and assessments carried out with parents and guardians.	The intervention performed proved to be promising in terms of occupational performance, social motivation, communication, cognition and behavioral improvement goals with reduced irritability and hyperactivity.
Petty, 2017	Caregivers completed the assessment of "Child's attitude and behavior towards animals" in the intervention (n=31) and	Total: 67 children, Diagnosis: ASD, Asperger, Age range: 6-16 years old, Gender: 60 men and 07 women.	Improved behavior, socialization and interaction with animals.	Protocol: 45-minute group sessions for 10 weeks. Activities: Horse lesson, riding skills activities, riding, handling, dismounting and brushing. Control Group: 1 class,	Caregivers in the intervention group reported care actions with pets, demonstration of emotions, improvements in behavior and social cognitive, through social interaction.

	control (n=36) groups.			without contact with horses.	Different from caregivers in the control group, with few positive responses.
Potvin, 2021	Analysis of parents' opinions on the impact of hippotherapy on lifestyle habits, according to the Disability Creation Process model.	Total: 26 children, Diagnosis: ASD, Autism, Age range: 7 years old, Gender: 14 men and 12 women.	Improved habits and quality of life.	Protocol: Duration of 2 months, where parents classified the categories and impacts on the children's life habits and the services offered in hippotherapy.	The children's guardians reported a positive impact on life habits, mobility and interpersonal relationships that involve social cognitive skills.
Steen, 2019	The instruments used were: reports/interviews with parents, observational videos, Scale for Emotional Development-Revised and Strengths and Difficulties Questionnaire.	Total: 1 child, Diagnosis: ASD, Range age: 8 years old, Sex: 01 woman.	Skills improvement during equine therapy sessions.	Protocol: 5 weekly sessions of 90-120 minutes. Activities: Relaxation, sensory exercises on the horse's back, therapeutic riding, longline, interaction games with practical rules and exercises with verbal commands.	Improved social levels, emotions and communication skills. And positive differences regarding the reports and observations of parents regarding the development of play and anxiety.
Tan, 2017	Interviews were carried out adapted from qualitative articles of Equine Assisted Intervention, without exploring the non-physical impacts of EAI.	Total: 6 children, Diagnosis: ASD, Age range: 3-14 years old, Gender: 01 men and 05 women.	Improvement of psychosocial areas and experiences acquired during interventions with horses.	Protocol: 5 weeks and in some cases 1 month of horse therapy. Activities: Fwere carried out according to the needs of each child and recordings of interviews with parents.	The benefits were at different psychosocial levels, such as: social cognitive, emotional and behavioral. These benefits were extended to parents and family members through ecopsychological effects.
Ward S, 2013	The evaluations used were: Battery Teacher of Clinical Evaluation, Gilliam-2 Autism Rating Scale and Sensory Profile Companion-SPSC.	Total: 21 children, Diagnosis: ASD and Autism, Age range: 3-11 years old, Gender: 15 men and 06 women.	Improved sensory skills and social communication.	Protocol: 6 weeks of therapeutic riding and classroom activities. Activities: The sessions consisted of orientation, assembly, riding and closing.	Increased social interaction, improved sensory processing, emotion, communication, procedural attention and reduced traits/symptoms of autism spectrum severity after intervention with horses.
Wuang, 2010	The evaluations used were: Bruininks-Oseretsky-BOTMP Motor Proficiency, Motor Performance Test and the Sensory Integration Function Test,	Total: 60 children, Diagnosis: Autism, Age range: 6-8 years old, Sex: 47 men and 13 women.	The riding simulator was effective in motor coordination and sensitivity in children with autism.	Protocol: 40 sessions of 60 minutes. Intervention Group: 20 weeks on SDHRP and regular therapies. Control Group: 20 weeks of regular therapy, then protocol reverts. Activities: Training of fine motor	Significant improvements in motor proficiency, sensory integration, social cognitive, visual and auditory processing. In addition, the therapeutic effects of the simulator are maintained for a period of

	in the intervention (n=30) and control (n=30) groups.			function and sensory integrative function.	approximately 24 weeks after the intervention.
Zhaoxing Pan, 2019	Analysis of cortisol levels through saliva and Systematic Analysis of Language Transcripts in the intervention (n=08) and control (n=08) groups.	Total: 16 children, Diagnosis: ASD, Age group:6-16 years old, Gender: 13 men and 03 women.	Reduction of hyperactivity in children assisted by horses.	Protocol:45-minute sessions for 10 weeks. Activities: Saliva collection, sit with a volunteer, review the group schedule, warm up and relax. Control Group: participants were exposed to a stuffed horse.	Effectiveness of cortisol as a target mediator for the effects of therapy on irritability and hyperactivity/biobehavioral behaviors. In addition to the positive effects on social cognitive and communication after equine therapy.
Zocante, 2021	The adaptive behavior scales of Vineland - Vineland-II, Developmental Coordination Disorder Questionnaire; PSI-SF and IEMS.	Total: 15 children, Diagnosis: ASD, Age group:7-15 years, Gender: 13 men and 02 women.	Improved adaptive skills and behavioral	Protocol: 20 sessions weekly 45 minutes for 6 months. Activities: Ground activities, preparation, complex activities, exercises with degrees of difficulty and verbal commands from professionals.	The results suggest improvement in motor functions, adaptive behaviors, development of complex skills and social cognitive, during and after activities and therapies assisted by horses.

## **CAPÍTULO II:**

### **Insights on cognitive effects of hippotherapy in children with Autism Spectrum Disorder and Intellectual Disability in Brazil**

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Clebert José Alves.

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**Insights on cognitive effects of hippotherapy in children with Autism Spectrum Disorder and Intellectual Disability in Brazil**

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**ABSTRACT**

*Background:* Considering the growing number of children with Autism Spectrum Disorder - ASD and Intellectual Disability - ID in hippotherapy centers, this study aims to analyze the profile of hippotherapy practitioners and identify the effects of hippotherapy on cognitive aspects in children with ASD and ID.

*Method:* Data and empirical observations were analyzed through procedures semi-assisted and online questionnaires, prepared by the authors and interdisciplinary professionals, based on the evaluations of the centers and the topics of the Brief Cognitive Screening Battery. Occurring in two moments, the first associated with the organization and structure of the hippotherapy centers located in the state of Paraíba, Brazil and the second with the cognitive effects from the perspective of the legal guardians of the practitioners.

*Results:* It was found that the three hippotherapy centers have a predominance of the neurological clinical picture, with a high number of cases of children with ASD and multiple disabilities. Among the cognitive effects analyzed in the sample composed of 15 practitioners with ASD and ID, positive changes were observed in the three cognitive domains, highlighting the cognitive and social aspects.

*Conclusions:* Hippotherapy promotes positive effects on the cognitive development of individuals with ASD and ID.

**Key words:**

Cognition; Hippotherapy; Autistic Spectrum Disorder.

## **What this paper adds**

It is estimated that in Brazil there are approximately 2 million children with traits of the Autistic Spectrum Disorder (ASD) and/or Intellectual Disability (ID), and the growing number of diagnoses of these conditions has become one of the main reasons for the search of alternative methods and therapies for cognitive development. Riding therapy is one of the main therapies used today. Despite the large number of studies carried out with different pathologies, there are a relatively smaller number of studies on hippotherapy for the cognitive effects in children with ASD and ID. The cognitive area is the one with the greatest commitment in cases of ASD and ID, especially in the functions of language, attention, behavior, emotional, learning and social interaction, thus causing changes in functionality and quality of life. Thus, this study provided insights into clinical evidence of the effects of hippotherapy on the cognitive development of children with ASD and ID.

## **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 (Swedo et al., 2014; Steiner & Kertesz, 2015).

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 & Simmonds, 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 & Gómez, 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. Method**

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 conducted 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 Paraíba State (ASPEQ) in João Pessoa; and the EquoPatos Equestrian Center, 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 in the areas of health, education and horseback riding participated in the study, of which two, in addition to riding therapists, acted as managers or directors of the centers. A total of 153 practitioners were treated at the hippotherapy centers, of which 52 were diagnosed with ASD and 11 with diagnosis or indication of ID. Of these, 21 legal guardians participated, all mothers of children with special needs who regularly attended (once a week) the aforementioned 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-presential 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% ( $P\text{-value} \leq 0.05$ ).

### **3. Results**

#### *3.1 Organizational, structural and profile analysis*

Questionnaire I made it possible to identify organizational and structural aspects of the three hippotherapy centers, which shared the following characteristics: classification as a philanthropic institution or association; active for more than six years with equestrian activities and therapies; teams composed of multidisciplinary professionals; volunteers in the areas of health, education and horse riding; working hours of professionals less than ten hours per week and free service for all individuals, including those from surrounding cities. In addition to riding therapy services, they also offer riding lessons and courses focused on animal welfare, riding therapy and/or riding.

As for the structural aspects of the centers, only one center did not have a covered area for activities and therapeutic practice; the soil present in the centers is of the sandy type, suitable for the practice of equestrian activities; all have places to saddle the horse and ramps that facilitate access and 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 professionals and clinicians of practitioners present in the centers, we can highlight the multidisciplinary teams, composed of physiotherapists, psychologists, physical educators, veterinarians, horseback riding professionals, pedagogues and/or psychopedagogues. It was also observed the presence of occupational therapists, social workers and doctors in two analyzed centers. As for the clinical profile of practitioners, there was a growing number of children and adolescents with neurological disorders, including from cognitive to behavioral deficits, where the main neurological pathologies identified were: Down's syndrome, ID, ASD, cerebral palsy, global development delay, Dravet syndrome, attention deficit hyperactivity disorder, sensorimotor disorders, and various neurological syndromes.

In Table 1 are presented the general characteristics of the 21 children who practiced hippotherapy. Most of the children was female (52.4%), five to nine years old (66.9%), with ASD (61.9%) and with incomplete elementary school (71.4%); however, there was statistical significance for age, special need and scholar degree.

### 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  $\geq 70\%$  for scores 4 and 5 regarding these significant effects (Table 2). It's noteworthy the absence of negative or regression effects (score 2).

## 4. Discussion

Riding therapy centers investigated in this survey presented installations, implantations and practical functioning of the hippotherapy centers established by the National Association of Hippotherapy (ANDE) of Brazil, as wide environment with covered areas and outdoors, places to seal the animals, suitable sandy soil, access ramps, minimal multidisciplinary teams and others (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 working in hippotherapy centers, depending on the goals set and the needs of practitioners (Brasil, 2019).

In the present study, by observing the special needs of practitioners, the clinical profile of practitioners present in the analyzed centers was identified, which is neurological, with a high number of cases of male practitioners with ASD and ID (61.9%), corroborating thus the studies focused on ASD and hippotherapy that point to a high prevalence of the male gender among practitioners of hippotherapy with ASD and/or ID (Gabriels et al., 2015; Ajzenman et al., 2013; Ghorban et al., 2013; Hameury et al., 2010; Kern et al., 2011).

Regarding the development of a positive perspective on the effects in the cognitive areas of practitioners with ASD and ID, the present study identified positive changes in the three main cognitive areas after the hippotherapy interventions. Positive responses associated with behavior are reported as one of the main results associated with exposure and intense contact with horse-assisted activities and therapies, which reflect in the reduction of irritability, stereotypies and aggression, in addition to minimizing inattention and general behavior changes (Bass et al., 2009; Ajzenman et al., 2013; Ward et al., 2013).

Despite the positive perspectives of those responsible for the areas of care and planning, the present study did not identify significant statistical differences related to these areas, thus justifying the absence of these cognitive aspects in the research carried out to date (Duarte, 2019; Fernández & Gómez, 2015; Gabriels et al., 2012). Although Steiner and Kertesz (2015) reaffirms the effects directed to the subareas of attention, which are associated with learning, memory, attention fixation, concentration, awareness and communication, being reported through the ability of hippotherapy to promote the activation of several brain areas, through of stimuli from the actions of neurotransmitters and neuromodulators in efferent.

For Petty et al. (2017), these stimuli are linked to the horse's sensorimotor system through repetitions of the three-dimensional movement performed by it. In order to produce spontaneous neural plasticity in practitioners, thus influencing the development of skills related to the second cognitive area, which involves social interaction, social motivation and environmental interaction. Regarding the positive effects aimed at the environmental interaction between practitioners with ASD and DI, we can highlight the interaction of the practitioner with the animal as one of the main factors, since ASD is characterized by the difficulty of living with people and the environment in which they live, while horses, despite being large, are highly sociable and receptive to subtle human stimuli, thus enabling more concrete learning about understanding behavior, sensory processing, functionality and social interaction (Tan & Simmonds. 2018; Fernández & Gómez, 2015; Gabriels et al., 2012; Ghorban et at., 2013).

However, there was no significant evidence related to motivation and social interaction of practitioners with ASD and ID linked to riding therapy. Overall, interaction and motivation social were described with positive effects practitioner; in the average scores of Questionnaire II items that ranged from 4 to 5 among practitioners, elucidating the high positive effects in both socio-cognitive areas. Therefore, the present study found that even without presenting significant statistical data related to all cognitive social areas, practitioners still benefit from riding therapy in social cognitive development after interventions with horses. These results corroborate with different studies carried out through weekly sessions of hippotherapy with practitioners with ASD or Autism (Vieira et al., 2020; Duarte et al., 2019; Lanning et al., 2014; Ghorban et at., 2013; Kern et al., 2011; Hameury et al., 2010; Bass et al., 2009).

As for the third area, related to emotional cognitive, there were significant positive effects relatively greater in aspects related to empathy than to social affective. Anderson and Meints (2016) state that the interaction between the horse and the rider generates an affective bond called man/horse symbiosis capable of activating the limbic system (responsible for emotions) of the rider when riding the horse, providing positive effects on the emotional aspects directed to the riders. feelings of empathy. These effects confirm the changes observed in this study.

Through the data exposed by this study, it is concluded that hippotherapy promotes positive effects on the cognitive aspects in general of children with autistic spectrum disorder and intellectual disability, highlighting whether the behavioral cognitive areas, environmental interaction and empathy that showed statistical significance in comparison with the other areas. However, taking into account the perception of the practitioners' legal guardians, we can also highlight the areas focused on social interaction and motivation, thus confirming the degree of satisfaction and the desire to continue with activities involving hippotherapy on the part of the practitioners' guardians, who stated that 99% were "very satisfied with the hippotherapy". Another objective served in this research was the identification and analysis of the clinical profile of practitioners of hippotherapy in the state of Paraíba, Brazil, which presented a neurological profile, with a predominance of cases of ASD and multiple disabilities.

### **Limitations and implications**

Therefore, this study provides clinical evidence of the effectiveness of hippotherapy in the cognitive development of children with ASD and ID, despite some limitations present during this study, such as the pandemic period caused by COVID-19, which made it impossible to apply the questionnaires in person and sample enlargement. As well, the existing assessment instruments for children with ASD and ID who practice hippotherapy do not clearly involve the cognitive aspects, thus justifying the development and adaptations of Questionnaire II by the authors and other health professionals. However, the results obtained are fundamental and reflect an important clinical possibility in the area of cognitive rehabilitation.

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**Author statement CRediT:**

Natália Soares Oliveira and Sérgio Santos de Azevedo: Project Management, Conceptualization, Methodology, Data Curation, Writing - Original Draft, Preparation of the original draft, Visualization, Investigation, Writing - Review and Editing. Carolina de Sousa Américo Batista Santos and Clebert José Alves: Visualization, Writing - Proofreading and Editing. Sérgio Santos de Azevedo: Supervision, Review and Editing.

**Ethics approval:**

The Ethics Committee for Research Involving Human Beings at the Federal University of Campina Grande – UFCG, Brazil, approved this study. All legal guardians of the children gave written informed consent prior to the start of data collection.

**Competing interests:**

The authors declare no conflicts of interest.

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**Table 1**

General characteristics of children who practiced hippotherapy

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

**Table 2**

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

Cognitive aspects	Scores					P-value
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	
Communication	...	...	2 (13.3)	8 (53.3)	5 (33.3)	0.158
Behavior	1 (6.7)	...	3 (20)	9 (60)	2 (13.3)	0.032
Attention	2 (13.3)	...	1 (6.7)	7 (46.7)	5 (33.3)	0.106
Planning	2 (13.3)	...	5 (33.3)	4 (26.7)	4 (26.7)	0.724
Social interaction	...	...	...	10 (66.7)	5 (33.3)	0.302
Environmental interaction	1 (6.7)	...	2 (13.3)	9 (60)	3 (20)	0.032
Social motivation	2 (13.3)	...	...	8 (53.3)	5 (33.3)	0.158
Social affection	1 (6.7)	...	2 (13.3)	5 (33.3)	7 (46.7)	0.106
Empathy	3 (20)	...	1 (6.7)	10 (66.7)	1 (6.7)	0.006

## CONCLUSÃO GERAL

Com base no que foi apresentado sobre os efeitos da equoterapia nos aspectos cognitivos de crianças com Transtorno do Espectro Autista – TEA e Deficiência Intelectual, foi possível concluir que o presente estudo é de grande relevância para as crianças e os indivíduos em geral com TEA e DI, uma vez que a principal área de comprometimento dessas patologias estão associados aos aspectos cognitivos e as habilidades sociais, observados neste estudo como os principais resultados obtidos através da prática da Equoterapia, destacando-se as áreas cognitiva e o cognitivo social. Do mesmo modo, para os profissionais que atuam nos centros ou associações de Equoterapia e os sistemas de saúde voltados para a reabilitação. Tendo em vista, o crescente número de casos de crianças com TEA, DI e multideficiências na atualidade.

Apesar dos estudos presentes na literatura, sente-se a necessidade da padronização dos instrumentos de avaliações e técnicas que abranjam o TEA e DI nos centros de Equoterapia. Vale ressaltar a importância de uma maior divulgação sobre a prática da Equoterapia em crianças com TEA, e a necessidade de novos estudos para ampliar o conhecimento em torno da temática, considerando que é indispensável o conhecimento para os profissionais, os responsáveis legais das crianças, os sistemas de saúde e a sociedade para que viabilizem o acolhimento e a compressão em relação à condição do TEA, da DI e sobre a equoterapia como método reabilitador. Por fim, anseia-se que este trabalho possa contribuir positivamente para a condução de novas pesquisas.

**ANEXOS**

## ANEXO I : Questionário I – Organizacional

(Questionário desenvolvido pelos pesquisadores, com base nas fichas de avaliações disponíveis nos centros e associações de Equoterapia)

1. Nome do Centro de Equoterapia:
  2. Em qual cidade o Centro ou Associação de Equoterapia está localizado?
    - Areia
    - Campina Grande
    - João Pessoa
    - Patos
    - Outro:
  3. Há quanto tempo o Centro está em funcionamento?
    - Menos de 1 ano
    - Entre 2 e 4 anos
    - Entre 5 e 7 anos
    - Mais de 7 anos
    - Mais de 10 anos
  4. O Centro apresenta-se como ?
    - Organização Privada
    - Organização Não Governamental – ONG
    - Outro:
  5. O Centro encontra-se credenciado a ANDE?
    - Centro Agregado a ANDE Brasil
    - Centro Filiado a ANDE Brasil
    - Outro:
  6. O Centro realiza atendimentos a pacientes ou praticantes de alguma entidade? Como por exemplo a APAE ou outra instituição?
    - Sim
    - Não
  7. Além da Equoterapia, o Centro realiza alguma das atividades citadas abaixo? ( Pode marcar mais de uma alternativa)
    - Aulas de equitação
    - Aluguel de baias
    - Cursos relacionados a Equoterapia e/ou Equitação
    - Todas as alternativas anteriores
    - Nenhuma das opções citadas
- *Com relação aos Profissionais que fazem parte da Equipe do Centro de Equoterapia:*
    1. Quantos profissionais fazem parte da equipe do Centro de Equoterapia?
    2. Quantos profissionais de Fisioterapia fazem parte da equipe do Centro de Equoterapia?

3. Quantos profissionais de Terapia Ocupacional fazem parte da equipe do Centro de Equoterapia?
  4. Quantos Psicólogos atuam no centro de Equoterapia?
  5. Quantos Educadores Físicos atuam no centro de Equoterapia?
  6. Quantos Assistentes Sociais atuam no centro de Equoterapia?
  7. Quantos Médicos Veterinários atuam no centro de Equoterapia?
  8. Quantos profissionais de Equitação atuam no Centro de Equoterapia?
  9. Quantos Pedagogos ou Psicopedagogos atuam no centro de Equoterapia?
  10. Quantos Médicos atuam no centro de Equoterapia?
  11. Há estagiários ou voluntários das demais áreas atuando no centro?
    - Sim
    - Não
  12. Com relação a carga horária da equipe, qual a média de horas por semana?
    - Menos de 10 horas
    - Entre 11 e 20 horas
    - Entre 21 e 30 horas
    - Entre 31 e 40 horas
    - Mais de 40 horas
  13. Os profissionais são remunerados?
    - Sim
    - Não
- *Com relação aos Praticantes:*
1. Quantos praticantes frequentam o Centro de Equoterapia? (Total de Praticantes)
  2. Qual a faixa etária ou público-alvo dos praticantes de Equoterapia?
    - Crianças de 1 a 14 anos
    - Adolescentes de 15 a 19 anos
    - Adultos acima de 20 anos
    - Idosos a partir de 65 anos
    - Todas as faixas etárias
  3. O Centro de Equoterapia possui Ficha de Avaliação para cada praticante?
    - Sim
    - Não
  4. O Centro de Equoterapia possui Ficha de Evolução ( Ficha destinada para descrever a conduta realizada após a sessão) de cada praticante?
    - Sim
    - Não



5. Qual o maior perfil desses praticantes ? (Pode marcar mais de uma alternativa)
  - Neurológico
  - Ortopédico
  - Respiratório
  - Cardíaco
  - Todos
  - Outro:
  
6. Caso o perfil seja Neurológico, quais as mais frequentes?  
( Pode marcar mais de uma alternativa)
  - Síndrome de Down
  - Deficiência Intelectual
  - Transtorno do Espectro Autista / Autismo
  - Lesão Medular
  - Paralisia Cerebral
  - Parkinson
  - Distúrbios de Comportamento
  - Esquizofrenia
  - Transtorno do Déficit de Atenção e Hiperatividade – TDAH
  - Síndromes Neurológicas
  - Microcefalia
  - Esclerose (Diversas)
  - Disfunções Sensório-motoras
  - Outro:
  
7. Caso no Centro tenha praticantes com Transtorno do Espectro do Autismo / Autismo, quantos realizam Equoterapia atualmente?
  
8. Com relação a Deficiência Intelectual, caso no Centro tenha praticantes com algum tipo de Deficiência Intelectual quantos realizam Equoterapia?
  - *Com relação aos Atendimentos de Equoterapia:*
    1. Quantas vezes na semana os praticantes são atendidos no centro?
      - 1 vez por semana
      - 2 vezes por semana
      - 3 vezes por semana
      - Mais de 3 vezes por semana
      - Outro:
  
    2. Qual a duração média de cada atendimento?
      - Entre 20 a 30 minutos
      - Entre 30 a 40 minutos
      - Entre 45 a 60 minutos
      - Mais 1 hora
      - Outro:
  
    3. Os atendimentos de Equoterapia são:
      - Individuais
      - Em dupla
      - Em grupo
      - Todas as alternativas anteriores

4. Dos praticantes atendidos, quantos fazem montaria dupla?
    - 2 a 4
    - 5 a 7
    - 8 a 10
    - 11 ou mais
    - Nenhum
  5. Qual o número médio de atendimentos realizados durante a semana?
  6. Em um mês quantos atendimentos de Equoterapia são realizados aproximadamente ?
  7. Qual a média de permanência dos praticantes na Equoterapia?
    - 1 mês
    - 2 a 3 meses
    - a 5 meses
    - meses a 1 ano
    - Mais de 1 ano
    - Outro:
  8. Qual a principal motivação da procura pela Equoterapia?
    - Indicação Médica
    - Indicação Fisioterapêutica
    - Indicação de Familiares
    - Indicação de Amigos
    - Meios de Comunicação
    - Outro:
  9. Quais as expectativas dos praticantes e seus familiares em relação a Equoterapia?  
( Pode marcar mais de uma alternativa)
    - Cura da patologia
    - Melhora significativa da condição patológica
    - Desenvolvimento motor
    - Interação social
    - Auxiliar o desenvolvimento cognitivo
    - Não sei informar
    - Outro:
  10. Os praticantes que frequentam o Centro fazem outro tipo de terapia ou atividade assistida?
    - Sim
    - Não
    - Alguns sim e outros não
- *Características Administrativas e Estruturais:*
1. O Centro possui ou aceita algum convênio ( Por exemplo: Planos de Saúde)?
    - Sim
    - Não
  2. Qual o valor médio de cada atendimento?
    - Inferior a R\$ 20,00
    - R\$ 20,00 a R\$ 30,00
    - R\$ 30,00 a R\$ 40,00

- R\$ 40,00 a R\$ 50,00
  - R\$ 50,00 a R\$ 60,00
  - Acima de R\$60,00
  - Os atendimentos são realizados de forma Gratuita
3. Quantos cavalos disponíveis para a prática de Equoterapia?
4. Quantas baias há no Centro? \*
- 1
  - 2 a 5
  - 6 a 10
  - Mais de 10
5. Há uma área coberta para a prática de Equoterapia quando o tempo não está favorável?
- Sim
  - Não
6. Quais os tipos de solo disponíveis? (Pode marcar mais de uma alternativa)
- Arenoso
  - Irregular
  - Regular
  - Gramado
  - Pedras
  - Todos
7. Existe um lugar adequado para encilhar o cavalo?
- Sim
  - Não
8. Para montar e apear os praticantes há rampas?
- Sim
  - Não
9. Com qual frequência é feita a higiene dos animais?
- Uma vez na semana
  - Duas vezes na semana
  - Quinzenal
  - Uma vez ao mês
  - Outro:
10. O Centro de Equoterapia funciona todos os dias úteis?
- Sim
  - Não

**TERMO DE CONSENTIMENTO \***

( ) Concordo que li e estou ciente da pesquisa, autorizando assim a utilização dos dados informados acima.

## ANEXO II : Questionário II –Para Pais ou Responsáveis Legais dos Praticantes de Equoterapia

(Questionário desenvolvido pelos pesquisadores e profissionais de saúde, com base nas fichas de avaliações disponíveis nos centros/associações de Equoterapia e da adaptação dos principais tópicos da Bateria Breve de Rastreio Cognitivo - Nitrini et al., 1994)

*\*Observação:* Como este questionário será respondido pelo responsável da criança que realiza Equoterapia, atribuímos as crianças participantes desta pesquisa o nome de "Praticante" ao longo das perguntas, de modo a não haver distinção ou diferença entre os mesmos, e de modo a atender também o termo designado pela literatura e evidências científicas aos Praticantes de Equoterapia.

1. Nome:
2. Cidade em que Reside:
3. Número do telefone para possível contato:
4. Levando em consideração que você responderá as questões direcionada a (as) criança (s) praticante (s) de Equoterapia. Gostaríamos de saber quem é o responsável pelas informações deste questionário?
  - Pai
  - Mãe
  - Os dois (pai e mãe)
  - Familiar
  - Responsável Legal
  - Profissional de Cuidados
  - Outro:
5. Gostaríamos de saber sobre o praticante (criança) que está sobre os seus cuidados. Então, qual o gênero do praticante (criança)?
  - Menino
  - Menina
6. Qual a idade do praticante (criança)?
7. O praticante (criança) apresenta algum diagnóstico clínico?
  - Sim
  - Não
  - Não sei informar
8. Caso sua resposta tenha sido "Sim", qual o diagnóstico clínico apresenta?
9. Em qual cidade realiza a Equoterapia?
  - Areia
  - Campina Grande
  - João Pessoa

- Patos
- Outro:

10. Há quanto tempo realiza a Equoterapia?

11. Quantas sessões de Equoterapia são realizadas por semana?

- 1 sessão
- 2 sessões
- 3 sessões
- 4 sessões
- 5 sessões
- Mais de 5 sessões

12. Em qual turno são realizados as sessões de Equoterapia ?

- Manhã
- Tarde
- Noite
- Os turnos das sessões variam, não apresentam um horário ou turno fixo.

13. Além da Equoterapia o praticante realiza outros tipos de terapias ?

- Sim
- Não

14. Qual é o grau de escolaridade do praticante (criança)?

- Não Estuda
- Maternal / Berçário
- Ensino Fundamental Incompleto
- Ensino Fundamental Completo
- Ensino Médio Incompleto
- Ensino Médio Completo
- Não sei informar

15. Com relação a residência do praticante (criança) . Qual o tipo de logradouro, ou seja, a localização?

- Zona Rural , Campo, Sítio ou Chácara
- Área Urbana, Cidade ou Distrito
- Outro:

• *Sobre o Praticante ( Criança) e a Equoterapia:*

-As perguntas a seguir deverão ser respondidas de acordo com as suas observações e experiências relacionadas as mudanças identificadas no praticante (criança) após as sessões de Equoterapia.

1. Com relação a interação social, ou seja, Interagir com as pessoas e / ou familiares houve alguma mudança?

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

2. Com relação a interação ou atitudes com o cavalo e os animais?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
3. Quanto ao ato de brincar ou de interagir com o ambiente?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
4. Observou alguma mudança relacionada a demonstração de afeto / carinho ou das emoções como felicidade, tristeza, raiva ou outros?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
5. Em relação aos comportamentos e o sentimento de empatia, ou seja, na forma de "pensar" ou "agir" com os outros em volta?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
6. Sobre compreender ou entender o que está sendo falado para ele (a)?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
7. Com relação aos comportamentos agressivos ou "agitados" ?
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas
  
8. Com relação a motivação? (Por exemplo: o praticante se sente mais motivado na realização das atividades e no dia a dia)
  - 1 - Não houve alterações
  - 2 - Regrediu ou apresentou respostas negativas
  - 3- Houve poucas alterações positivas
  - 4- Houve alterações positivas
  - 5- Houve muitas alterações positivas

9. Quanto a atenção e concentração nas atividades do dia a dia ?

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

10. Com relação a realizar atividades da vida diária, ou seja, atividades do dia a dia ?  
( Como por exemplo: vestir-se, calçar o tênis, pentear o cabelo, escovar o dentes, se alimentar sozinho e outros).

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

11. Como é a forma de comunicação do praticante (criança)?

- No momento não fala
- Através de gestos com significado, como dar tchau ou apontar para algo que deseja.
- Balbuciar sílabas repetidas – “bababa”, “mamama”, "papa" e outras.
- Através de olhares
- Consegue falar palavras simples
- Não apresenta dificuldades na fala

12. Quanto a comunicação, a fala ou gestos utilizados para se comunicar houve mudanças após as sessões de Equoterapia?

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

13. Com relação a aprender coisas novas?

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

14. Em relação a memorizar palavras, gestos, brincadeiras ou ações ?

- 1 - Não houve alterações
- 2 - Regrediu ou apresentou respostas negativas
- 3- Houve poucas alterações positivas
- 4- Houve alterações positivas
- 5- Houve muitas alterações positivas

15. Você se sente satisfeito com os resultados que o praticante (criança) tem apresentado depois que iniciou a Equoterapia ?

- 1 - Muito insatisfeito
- 2 - Insatisfeito
- 3- Indiferente, não observei resultados até o momento
- 4- Satisfeito
- 5- Muito satisfeito

16. Como responsável pelo praticante, você pretende continuar a participar da Equoterapia?
- Sim
  - Não
  - Talvez

\*Após a leitura do TERMO DE CONSENTIMENTO LIVRO E ESCLARECIDO -TCLE, descrito acima ... ( )Concordo que li e estou ciente da pesquisa, autorizando assim a utilização dos dados informados acima.