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The Effect of EAAT on Autism: a Literature Review

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ABSTRACT

The literature review conducted for this article revealed that there are very few studies about EAAT in the international literature. Although EAAT is used for psychiatric disorders, autism and behavioral disorders, the overall effectiveness of EAAT for many of the indications is unclear and more research has been recommended. The symptoms of ASD necessitate a multi-faceted therapeutic approach and the role of EAAT is substantial. The literature review shows that EAAT is an effective intervention, which can complement the range of different therapeutic actions taken to deal with such type of disorders.

KEYWORDS

Autism developmental disorders; Equine assisted activities and therapies; Hippotherapy; Therapeutic riding.

1. Introduction

ASD is a predominantly inherited disorder, but the possibility that other factors also contribute cannot be ruled out. It has been found that in families where one child has ASD, the likelihood of another child having the disorder is 35–40% greater than the general population average [1, 6]. The term used in this article to refer to a treatment with the involvement of the horse is Equine-Assisted Activities and Therapies (EAAT) and "therapeutic horseback riding" (THR). EAAT for people with an impairment include therapeutic riding, equine-assisted psychotherapy and hippotherapy (HT) [7]. THR is a subtype of equine assisted activities [8, 9] and an adapted exercise program from Equitation. The purpose is to contribute positively to cognitive, physical, emotional and social well-being of people with disabilities. THR provides benefits in the areas of therapy, education sport and recreation & leisure [10]. According to Sterbaetal. "Sports therapy" is the enjoyment of any sport which results in improvements in gross motor function for individuals having neurological disorders or developmental disabilities [11, 12]. As horseback riding rhythmically moves the rider's body in a manner similar to a human gait, riders with physical disabilities often show improvement in flexibility, balance and muscle strength. The introduction of sports therapy in the early formative years may have a significant impact on accelerating the rehabilitation of children with neurological disorders or developmental disabilities [11, 13]. In addition to the therapeutic benefits, THR also provides recreational opportunities for individuals with disabilities to enjoy the outdoors [10]. THR is used as part of an integrated

treatment program to achieve improvements in posture, balance, mobility, walking energy expenditure, function and sensory abilities [10, 14-17]. Through THR it is possible to reduce negative behavior in children and to teach them to manage their anger an easily regain their self-control. This is possible because the horse is used as an incentive, while punishing and rewarding the children's behavior, as it fills them with enthusiasm, satisfaction and positive emotions [18]. The non-judgmental nature of horses helps create a bond between the horse and the child, encouraging the child to create an emotional bond with another creature, the horse, which is generally hard for children with ASD [8]. The literature review conducted for this article revealed that there are few studies about THR and EAAT in the international literature. Although there are not a significant number of studies that discuss the positive impacts of THR and HT, fewer studies use a control group and include quantitative data. The systematic review conducted in this paper provides a quantitative overview of recent developments and findings, enhancing and contributing to up-to-date literature in this scientific field.

2. Materials and Methods

The study has been designed and the results have been reported based on PRISMA statement. PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses and focuses on the reporting of reviews evaluating randomized trials [19].

2.1 Eligibility Criteria

The studies included in this review concern published trials (in the English language) involving children with autism, focusing on the intervention effects of EAAT on behavior, socialization, sensory integration and quality of life. A main criterion for selecting studies to be included in this review was that the effects of EAAT were assessed in a quantitative manner.

2.2 Inclusion and Exclusion Criteria

Only studies with a control/comparison group, or selfcontrolled studies performing pre-intervention and postintervention assessment have been included. The studies excluded involved (i) studies not providing data on baseline score or end-point outcome, (ii) case studies, (iii) studies providing only qualitative data and (iv) studies that used a mechanical horse. Exclusion criteria were set for cointerventions such as medication or surgery that might have influenced the outcome. To increase the reliability of citation selection, all potentially relevant citations were reviewed independently by two investigators.

Database of Systematic Reviews, Cochrane Controlled Trials Register, PEDro, DARE, Google Scholar, Scopus, ISI Web of Science and Dissertation Abstracts using the following search terms to record studies on THR or HT published until the 30th of February, 2017. The search algorithm used was: "therapeutic riding" OR "therapeutic horse riding" OR "therapeutic horseback riding" OR "horse riding" OR "horseback riding" OR hippotherapy OR "equine-assisted therapy" OR "equine-assisted movement therapy" OR "equine therapy" OR "equine movement therapy" OR "developmental riding therapy" OR "riding for the disabled". The search was limited to English language articles. Hard copies of Pediatric Physical Therapy, Gait and Posture, Developmental Medicine and Child Neurology, American Journal of Physical Medicine & Rehabilitation, Archives of Physical Medicine and Rehabilitation and Physiotherapy Theory and Practice were also searched. In addition, abstracts of the Gait and Posture conference and Developmental Medicine were also searched for relevant articles. Finally, the reference lists of the articles included were cross-checked for any additional studies and systematic reviews or metaanalysis that may have been previously missed.

2.3 Data Extraction

From each eligible scientific paper the following information was extracted: first author, year of publication, country, total sample size, characteristics and statistics of children, EAAT protocol, duration of interventions, outcomes, follow-up duration, measures used to evaluate the efficacy of interventions, baseline and end-point measurements. Any additional interventions that were administered were also recorded. Data extraction was performed by the lead author and was checked by one of the co-authors.

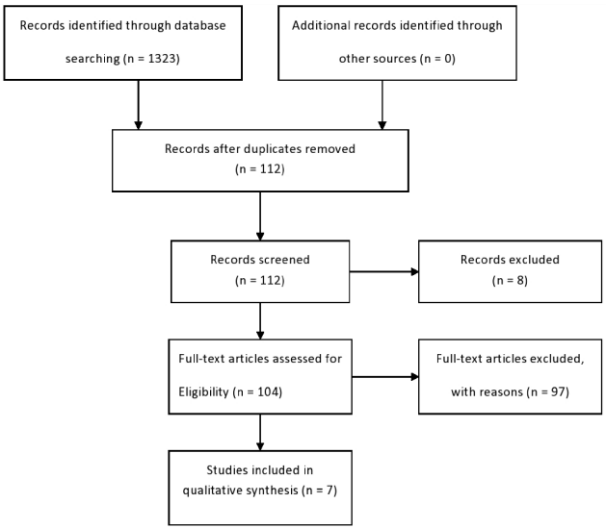

Figure 1. Prisma 2009 Flow Diagram [23].

The methodological quality of each study was evaluated independently by two of the co-authors and differences were resolved by a third. Evaluation was performed using Downs and Black quality assessment tool. Downs and Black checklist consists of 27 items categorized into 4 sections: reporting (10 items), external validity (3 items), internal validity (bias: 7 items, and confounding: 6 items), and power (1 item). Twenty-five items were scored as yes=1 point no=0 or unable to determine=0, item 5 as yes=2 partially=1 no=0, and last item 27 scored from 0 to 5 points and therefore each study was attributed a total Downs and Black score (range from 0 to 32). The mean (SD) Quality Index Score for randomized controlled trials was 14.0 ((6.39); skewness −0.07) and for non-randomized studies 11.7 ((SD) 4.64; skewness −1.10) [20]. The kappa statistic was used in order to determine the inter-rater reliability, a measurement of the extent to which data collectors (raters) assign the same score to the same variables [21, 22].

3. Results and Analysis

The literature review and the application of the eligibility and inclusion/exclusion criteria led to the detailed assessment of seven studies.

3.1 Quality Assessment

Agreement between the two raters was 90.5%. The interrater reliability kappa statistic [24], was equivalent to 0.80 (standard error 0.05) indicating an almost perfect agreement between the two investigators.

According to figure 2, out of the seven studies reviewed few are those with a low score. The lowest score was noted for Ward et al, with a score of 16, and the highest was noted for Gabriels et al, with a score of 27. More specifically, one study scored 22 on the Downs and Black scale, one study scored 20 and three studies scored 19.

Seven clinical trials of EAAT in children with ASD fulfilled the inclusion criteria and were used in this review. The total number of participants (children) studied was 336, out of which 185 participants were an HT and TR intervention group, 151 participants were a control group. It was not possible to conduct a meta-analysis as the measurements of individual studies did not allow for such an quantitative studies were very few and the different approach. Significant improvements are shown in table 1.

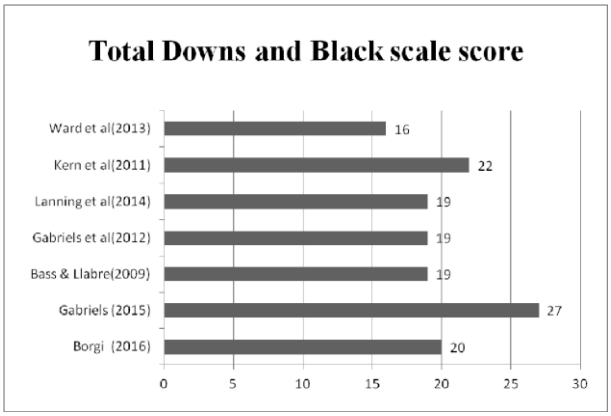

Figure 2. Total Downs and Black scale score.

Table 1. Characteristics of the study.

Fist Author / Year		Interv	Post			Duration & description of Intervention
			RandN	Mean	SD	
Kern 2011 [7]						60 min EAA for 6 months
Kern 2011 [7]						Waiting list period 60 min
Kern 2011 [7]						THR/week for 12 weeks
Kern 2011 [7]						Waiting list
Bass		EAA	24	3.74	0.60	
2009 [8]		EAA	24	10.61	2.06	
Bass		CG	24	3.50	0.65	
2009 [8]		CG	24	8.91	2.74	
Bass		THR	19	269.4	51.6	
2009 [8]		THR	19	62	9	
Bass		THR	19	27	4.6	
2009 [8]		THR	19	17.2	2.6	
Bass		THR	19	16	3.3	
2009 [8]		THR	19	73.6	24.1	
Bass		THR	19	12.5	5.9	
2009 [8]		CG	15	245.7	50.3	
Bass		CG	15	53.2	10.5	
2009 [8]		CG	15	21.4	4.5	
Bass		CG	15	15.7	4.8	
2009 [8]		CG	15	11.3	4.8	
Bass		CG	15	94.4	32.1	
2009 [8]						
Bass						
2009 [8]						
Bass						
2009 [8]						
Bass						
2009 [8]						
Bass						

2009 [8]					
Fist Author / Year	Interv	Post			Duration & description of Intervention
		RandN	Mean	SD	
Bass 2009 [8]	CG	15	16.2	6.7	
Gabriels 2012 [25]	THR/CG*	42	12.9	8.5	
Gabriels 2012 [25]	THR/CG*	42	6.3	7.1	60 min THR/week for 10 weeks
Gabriels 2012 [25]	THR/CG*	42	3.3	3.5	
Gabriels 2012 [25]	THR/CG*	42	17.1	11.6	
Gabriels 2015 [26]	THR	62	9.5	7.98	
Gabriels 2015 [26]	THR	62	14.3	9.66	
Gabriels 2015 [26]	THR	62	17.6	5.55	TR minimum of 45 minutes for 10 weeks
Gabriels 2015 [26]	THR	62	30.2	8.75	
Gabriels 2015 [26]	THR	62	116.7	66.00	
Gabriels 2015 [26]	THR	62	253.7	154.62	
Gabriels 2015 [26]	CG	65	13.6	10.08	
Gabriels 2015 [26]	CG	65	18.4	10.26	
Gabriels 2015 [26]	CG	65	19.1	5.64	without horses/ similar employed methods
Gabriels 2015 [26]	CG	65	33.6	11.3	
Gabriels 2015 [26]	CG	65	118.4	62.75	
Gabriels 2015 [26]	CG	65	270.5	162.88	

Kern et al found that for 20 children who participated in the group of equine assisted activities (EAA) compared and compared them against a control group of 20 children and found that the activity led to a reduction in the severity of autism symptoms. More specifically, there was a significant decrease three months after the EAA treatment ($p<0.02$) and six months after ($p<0.005$). In the Timberlawn Parent-Child Interaction Scale [29], the participants showed a significant improvement in Mood and Tone after EAA ($p<0.005$ after 3 months and $p<0.02$ after six months), [30] reports a statistically significant improvement in Auditory High Threshold of Sensory Profile after three months ($p<0.02$) and after six months ($p<0.03$) and a marginal improvement in the reduction of Negative Regard at 6 months of EAA.

Ward et al in their study presented a significant ($p<0.05$) decrease on the Autism Index. Also, for in 21 participants a decrease was found between Weeks 23-30 (when THR resumed) in the second edition of the Social Interaction of Gilliam Autism Rating Scale (GARS-2), presented in detail in [31]. In the Sensory Profile School Companion (SPSC) reported in Dunn the school factor 4 (i.e. availability for learning in the learning environment) improved significantly only after 3 weeks of THR. Also, registration (i.e. limited/passive reaction to sensory stimuli), sensitivity (i.e., tolerance of sensory stimuli), and school factor 1 (i.e. need for sensory input) scores of the SPSC significantly improved after the full 8-week of THR [28].

Bass et al reported that there was a statistically significant change in the total means of sensory profile [30] as well as in four subscales of the sensory profile (Sensory seeking, Inattention/distractibility, Sensory sensitivity and Sedentary) in the 19 children of the THR group, while the means for the 15 children of the control group remained unchanged. Also, in the THR group a statistically significant change was found in the total score of Social Responsiveness Scale (SRS) [32] and in the subcategory of SRS “social motivation” [8].

Gabriels et al studied 42 children with autistic or Asperger's disorder in intervention group and 16 individuals in control group. Participants after the 10th week of THR showed significant improvements on measures of Irritability, Lethargy, Stereotypic Behavior, Hyperactivity, expressive language skills, subscales of the Aberrant Behavior Checklist-community (ABC-C)[33], motor skills, and verbal praxis/motor planning skills subscales of BruininksOseretsky Test of Motor Proficiency [34]. When compared to the pre- and post-assessments of participants from the control group, the THR group showed significant improvements in Irritability, Lethargy, Stereotypic Behavior, and Hyperactivity of the ABC-C [25].

Lanning et al investigated the impact of Equine Assisted Activities (EAA) as an intervention for 18 children diagnosed with ASD (intervention group:10, control group:8). They used two instruments, the Pediatric Quality of Life 4.0 Generic Core Scales (PedsQL) [35] and Child Health Questionnaire (CHQ) [36]. Parents noted significant improvements in their child's physical, emotional and social functioning, subscales of PedsQL, following the first 6 weeks of EAA. The children in the control group also demonstrated improvement in behavior, but to a lesser degree [9].

Gabriels et al studied 116 children with autistic disorder (intervention group: 58 and control group:58). The study showed there was a statistical significant difference in 58 children of THR group in subscales Irritability ($p=0.02$) and Hyperactivity ($p=0.01$) of Self Regulation (ABC-C) [33], on the Social Cognition ($p=0.05$) and Communication ($p=0.003$) subscales of Social Measure (SRS) [32] and also in the Systematic Analysis of Language Transcripts (SALT) [37] in subscacales "the use of different words" ($p=0.01$) and "spoke more words" ($p=0.01$) [26].

Borgi et al studied 15 children in an intervention group and 13 children in a control group and found that the Equine Assisted Therapy (EAT) group had a significant improvement in the domains of Vineland Adaptive Behavior Scale (VABS) [38] socialization ($p=0.034$) and motor skill ($p=0.021$). Also, in Tower of London (TOL) [39] the group of EAT showed significant improvement in a time-depended change in children 's latency to implement the first move during the problem- solving task ($p=0.026$) [27].

4. Discussion

There is a lack of literature in the area of the effects of EAAT in autism. Furthermore, in most of the studies the sample used is too small. Generally, it was observed that EAAT have a significantly positive impact on children with ASD. More specifically, EAAT significantly improves the psychosocial parameters and the children's overall quality of life, regarding their mood, sensory integration and socialization.

To ensure comprehensive treatment of a person with ASD, an evaluation of the individual's level of functionality and needs, as well as his/her family's, must take place, symptoms and other disorders that need to be addressed should be prioritized, the aims of the educational intervention must be set, actions for the systematic care of the individual's physical health must considered, the application of different therapeutic approaches in different stages of the person's life and the factors influencing the therapeutic process must be assessed.

Sensory-based interventions are prevalent and widely used with children with ASD [40]. Children who have received early intensive behavioral and developmental interventions have demonstrated improvements in cognitive, language, adaptive, and ASD impairments compared with children receiving low-intensity interventions and eclectic non-ABA (Applied Behavior Analysis) based intervention approaches. Also children who have received targeted play-based interventions (e.g., joint attention, imitation, play-based interventions) demonstrate improvements in early social communication skills. [41] According to this review EAAT in

children with ASD improves mood and tone [7], irritability, lethargy, stereotypic behavior, hyperactivity [25], physical, emotional and social functioning [9] and sensory integration [8, 28].

According to Bass et al, THR helps children increase their confidence, trust, self-respect and communication skills which are then transferred to their everyday lives [8]. According to Mackinnon et al the psychosocial benefits of TR are attention, concentration, listening skills, selfconfidence, self-awareness, self-esteem and motivation [42].

There are some therapeutic/educational interventions such as THR, which can reduce, in certain cases dramatically, children's negative behavior and improve skills for a more independent life. Therapeutic – educational interventions must always be adapted to individual needs.

5. Study Limitations

The limitations of this review were that there are few clinical trials with control group, therefore i) more quantitative study results are needed to assess the outcome of the intervention ii) it would be useful to define common, standardized and weighed measurements which could then be used in a meta-analysis, iii) the studies conducted should include a larger sample and greater homogeneity of the target group, iv) the programme duration as well as the duration of the therapy sessions should increase, iv) the specific intervention with respect to other types of educational/therapeutic interventions should be evaluated, v) the duration of the benefits acquired through EAAT should be investigated and the duration for which this can have a positive impact on children with ASD should be studied further.

6. Conclusions

The literature review conducted for this article revealed that there are very few studies about EAAT in the international literature. Although EAAT is used for psychiatric disorders, autism and behavioral disorders, the overall effectiveness of EAAT for many of the indications is unclear and more research has been recommended.

The symptoms of ASD necessitate a multi-faceted therapeutic approach and the role of EAAT is substantial. The literature review shows that EAAT is an effective intervention, which can complement the range of different therapeutic actions taken to deal with such type of disorders.

Overall, there is a need to determine the efficacy of EAAT aiming to improve the daily activity and participation level of children with ASD to increase their self-competence or quality of life. According to this review, interventions such as EAAT and generally the use of the behavior or the motion of the horse as a therapeutic tool, is a viable intervention option for children with ASD in cognitive, emotional and social well-being. Also THR improve the posture, balance, mobility, walking energy expenditure, function and spasticity in individuals with neuromuscular diseases. Individuals who attend such an intervention have the opportunity to simultaneously experience, benefit and enjoy the activity outdoors.

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