DANCE AND EQUINE-ASSISTED THERAPY IN AUTISM SPECTRUM DISORDER: CROSSOVER RANDOMIZED CLINICAL TRIAL

Caroline Souza-Santos, Josefa Franciane dos Santos, Isabela Azevedo-Santos, LavíniaTeixeira-Machado

Abstract

Objective: Autism spectrum disorder (ASD) is a neurodevelopmental disorder, that compromising social interaction and communication by restriction of activities and interests. The aim was to investigate the influence of dance, and Equine-Assisted Therapy (EAT) in children with ASD.

Method: A sample of 45 articipants were allocated into three intervention groups (Dance, EAT, Dance & EAT), randomly distributed and going through twenty-four sessions (one-hour, twice a week) in each group (n=15 subjects each). Pre and post-treatment were carried out using the Functional Independence Measure, World Health Organization Disability Assessment Schedule, and Childhood Autism Rating Scale.

Results: Dance improved functional independence (p=0.03), communication (p=0.01), and psychosocial adjustments (p=0.02). Functioning was improved on Dance group after intervention (p=0.04). Intergroup analysis evidenced significantly greater improvements in classification of functioning in Dance & EAT group (p=0.0001).

Conclusions: Contact and relationship with horse is an activity that is part of rehabilitation process. Corporal dialogue happens when the body dances can open the possibility of new ways that help the individual to live and to deal with the different and differences.

Key words: autism spectrum disorder, dance, Equine-Assisted Therapy, physical therapy

Declaration of interest: none

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1. Introduction

Autism spectrum disorder (ASD), by the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V), is a neurodevelopmental disorder, that compromising social interaction and communication by restriction of activities and interests, they vary according to the degree of the disorder and how to express itself, with the others and the environment. Therefore, ASD presents qualitative and quantitative impairments in verbal and non-verbal communication (Bhat et al. 2017, Yamasaki et al. 2017).

Although there are several studies in this regard, genetic risk factors are still difficult to identify. It is believed that its cause is multifactorial and may be genetic, neurobiological and environmental. Recent studies elucidate the role of epigenetics in possible environmental risks and biological mechanisms interaction for ASD development (Gomes et al. 2015, Tordjman et al. 2014).

As the clinical features of ASD begin to appear, they affect their physical and mental conditions, which increase the level of ASD functional dependence in various prisms, which requires a greater demand for parental care and professional interventions (Kelly 2015, Bremer et al. 2016). Because of this, intervention must focus on communication and functionality, which minimizes neuropsychomotor deficits.

It is important for the achievement of functional independence and quality of life improvement, as well as to improve neuropsychomotor skills, which influence stereotyped movements, verbal and nonverbal language and ASD communication and social reciprocity (DuBois et al. 2017, Teixeira-Machado 2015).

Evidence-based interventions focusing exercises can improve several behavioral outcomes. A systematic review conducted by Bremer et al (2016) have evidenced horseback riding can produce greatest effects on stereotypic behaviors, social-emotional functioning, cognition and attention.

Thus, horseback riding is proposed as one possibility of intervention widely used as equine-assisted therapy (EAT), which uses horse as a therapeutic resource.

Submitted March 2018, Accepted July 2018

It provides positive effects on social, emotional and physical domains, and improvements in clinical manifestations caused by ASD, as social responsiveness and motivation, language and communication, as well as the reduction of behavioral and stress problems (Ajzenman et al. 2013, Anderson and Meints 2016, Borgi et al. 2016, Gabriels et al. 2015, Harris and Williams 2017, Lanning et al. 2014, Llambias et al. 2016, O'Haire 2013).

Another possibility to intervene in neuropsychomotor function is dance. Dance is one of the oldest forms of communication and expression of man, and it encourages learning through body action that stimulates own initiatives (Farias and Teixeira-Machado 2016). According to Teixeira-Machado (2015), dance provides several benefits for ASD in relation to interpersonal interaction, like social reciprocity and communication, in addition to the range of benefits it provides in the sensorimotor framework, that enables the improvement of functional, intellectual and social abilities.

Characterized as a serious neurodevelopmental disorder related to various neurological and psychiatric adversities, one of the most restrictive symptoms of ASD is the difficulty of relationship, perhaps this difficulty is involved with functional impairments in ASD. So, we hipothetized (1) EAT associated to an Dance Program potentiate sensorimotor effects, (2) these proposals affect different ways when motor activities are performed with and without an animal present, and (3) the psychosocial impact of artistic presentations on a stage. Thus, this study suggested a crossover design to investigate the influence of dance and EAT in children with ASD.

2. Method

2.1. Study Design

This is a cross over controlled clinical trial with randomized and blinded distribution. Participants with ASD (diagnosed by psychiatrists) were included in the following groups: (1) Dance group (DG); (2) EAT group (EG) and, (3) Dance and EAT group (DEG). For this, random distribution was performed in the order in which the participants were included in the study, according to a computer-generated distribution, which was prepared before beginning data collection.

2.2. Subjects and Ethic Contents

It was included children with ASD between five and twelve years old, both sexes, diagnosed by child psychiatrist meeting the diagnostic criteria by DSM-V, more than thirty-one points by Childhood Autism Rating Scale (CARS), no other forms of physical therapy performed by the participants during the study, no other medical condition (Park and Kim 2016, Wilson et al., 2017).

A sample of 56 subjects was eligible to begin participation in the study. Six participants were excluded from the study because they had the age under of five years old. Thus, 50 subjects began the research. During protocol implementation three participants given up to participate in the study and other two moving out. Forty-five participants were distributed in three research groups (**figure 1**).

Data regarding age, sex, weight, height, body mass index, and medication used by participants were similar between groups in pre-treatment (**table 1**). Assessments and intervention protocols were approved by the Ethics Committee in Research with Humans. Upon accepting the intervention, parents and / or guardians signed the informed consent form, authorizing participation in the study.

2.3. Procedures

All participants were allocated into one of three intervention groups (DG, EG, DEG), randomly distributed and undergone 24 sessions in each group, lasting 60 minutes, twice a week, totaling 72 sessions at the end of the study. Two trained examinors applied the evaluation measures at baseline, at 24th session, at 48th session and at 72th session. All participants underwent through all intervention groups. Each session were divided into four modules: warm-up, flexibility training, balance and relaxation training (**figure 2**).

2.4. Protocols

2.4.1. Dance

A special dance program developed for people with disabilities (called TALT) in a suitable place, under supervision of a trained dancing master, was performed

Figure 1. *Timeline of crossover study protocol. CARS: Childhood Autism Rate Scale. WHODAS: World Health Organization Disability Assessment Schedule, 2.0 version. FIM: Functional Indipendence Measure. EAT: Equine-assisted therapy*

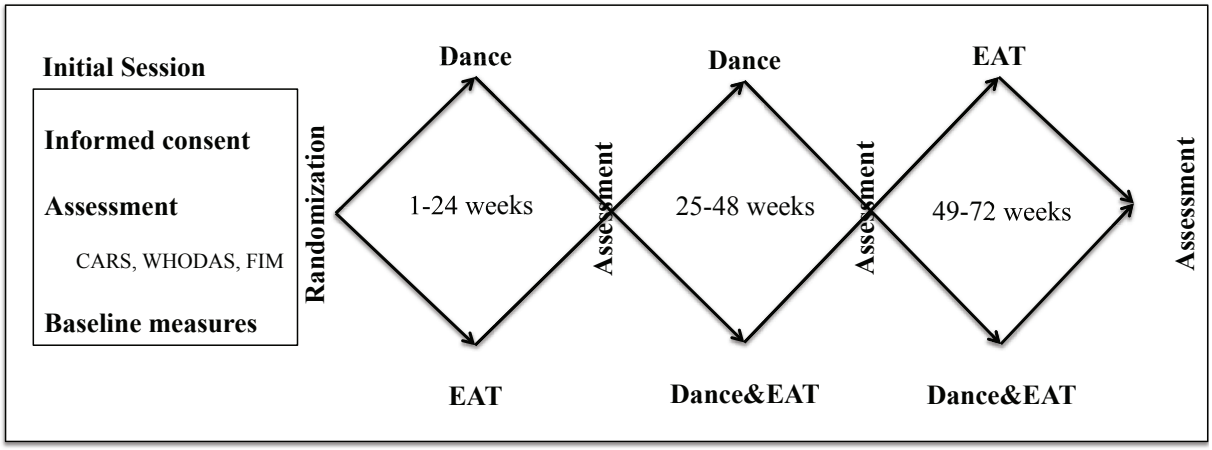
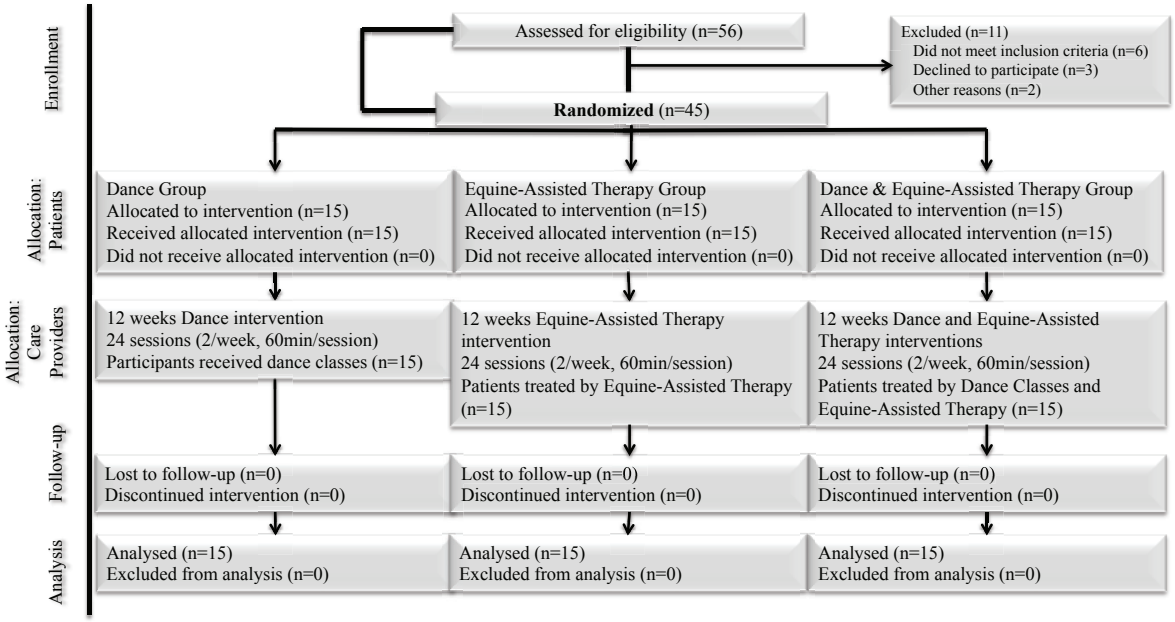


Table 1. *Baseline data by Dance, Equine-Assisted Therapy and Dance & Equine-Assisted Therapy Groups*

Data	Dance Group	Equine-Assisted Therapy Group	Dance & Equine-Assisted Therapy Group	P value
	N=15	N=15	N=15	
Age (years)	7±1.09	7±1.09	7±1.09	1
Female	3	3	3	
Male	12	12	12	
Height (m)	1.33±0.05	1.33±0.05	1.33±0.05	1
Weight (kg)	26.62±4.21	26.62±4.21	26.62±4.21	1
BMI (kg/m^2)	17.24±1.33	17.24±1.33	17.24±1.33	1
CARS	33.09±8.01	36.70±3.55	33.90±3.07	0.51
Drugs (dosage / administration)				
Risperidone 1mg per mL oral solution per day	15	15	10	
Carbamazepine 500mg / tablet per day	3		3	
Pericyazine 20mg / tablet per day		3		

Mean±SD. ANOVA Test.

Figure 2. *Flow diagram of the study*



twice a week, in a suitable classroom, lasting 60 minutes each, over a period of twelve weeks, totaling 24 meetings. Each class was divided into: warm-up (body conditioning); assembly of choreographies (body coordination, memory, perception and rhythm); and relaxation (final phase). In the end of intervention protocol, DG showed a performance in a public presentation.

2.4.2. Equine-assisted therapy (EAT)

This protocol was composed by 24 sessions of EAT were carried out twice a week, during 60 minutes, in an appropriate outdoor place, with 2000 m². Qualified therapist conducted each session, and consisting of: horse approach, touch stimulation; ride and course with varied riding. Participants actively rode a horse with verbal commands and visual clues. The paths were: aclive, slope and flat grounds. The types of ground were of beaten ground, grass and gravel. All the participants went through all the horse speeds (step, trot and gallop), with the help of the therapist or only with the verbal commands of the therapist. Also, some circuits with colored bowls and balls, hula-hoops, and soccer ball were carried out to performed activities of memorization, throwing, counting.

2.4.3. Dance with equine-assisted therapy (DEG)

Children in this group performed 24 sessions, twice a week, with one day for each intervention: Dance or equine-assisted therapy, during 60 minutes, each, in suitable locations and with the protocols described above.

Dance classes used music as a resource in the activities performed, as well as public presentations

in schools, health units and theaters; and EAT sessions used the horse as the main therapeutic tool.

2.5. Assessments

2.5.1. Psychometric Data

Childhood Autism Rate Scale (CARS) was used to analyze the effects on aspects related to autism graduation. This scale is a 15-item scale that assists identification of children with ASD. It allows differentiate to mild-moderate from severe, and its use is indicated for any child over two years of age. Results indicate the following score: 15-30: no autism; 31-36: mild-moderate autism; 37-60: severe autism (Park and Kim 2016, Wilson et al. 2017).

2.5.2. Functioning and Independence

Functional Independence Measure (FIM) was used to assess functional disability. Its main objective is to quantitatively assess the burden of care that a person needs to perform motor and cognitive tasks of daily living. These tasks evaluated self-care, transfers, locomotion, sphincter control, communication and social cognition, which include memory, social interaction and problem solving. Each domain is evaluated and receives a score ranging from 1 (total dependency) to 7 (complete independence). Total score ranges from 18 to 126 (Wong and Chen 2010).

2.5.3. Social participation

Social participation was assessed by WHO Disability Assessment Scale, version 2.0 (WHODAS 2.0), is composed by six domains of life (cognition, mobility, self-care, coexistence with people, life activity and participation in society). It is organized into 36 questions, with scores ranging from 0 to 4 points in each item (Huang et al. 2017).

2.6. Statistical Analysis

All statistical analysis was performed using SPSS software, version 16.0. Data are expressed as Mean (Standard Deviation) – Mean (SD). Shapiro-Wilk test was used to verify normality distribution. Analysis showed normal distribution data, ANOVA test was used. Data with p value ≤ 0.05 were considered statistically significant.

3. Results

Dance, EAT and Dance associated to EAT contributed to ASD symptoms reduction in participants, as measured and observed by CARS (pre 39.8 ± 1.7 and post treatment 31.3 ± 3.71 (p = 0.01), EG: pre 36.6 ± 1.76 and post treatment 32.7 ± 1.64 (p = 0.03) DEG: pre 39.1 ± 2.22 and post treatment 31.2 ± 1.38 p = 0.02)) (**figure 3**).

Children in the DG improved functional independence (p=0.03) (**figure 4**). In relation to functional independence domains, Dance Group improved after intervention in communication (p=0.01) and psychosocial adjustments (p=0.02) (**figure 5**).

In relation to social participation, the Dance Group and Dance associated with EAT have significant post-treatment improvements (p=0.04 and p=0.0001). Comparing groups, Dance associated to EAT was more promising than EAT isolated (p=0.03) (**figure 6**).

4. Discussion

Study findings revealed positive results regarding autism degree, functionality and social participation, evidenced through assessments used in this study, namely: CARS, FIM and WHODAS 2.0 respectively. The most relevant result was participant adherence; in pretreatment they presented difficulties in activities

Figure 3. *Pre and post-treatment Childhood Autism Rate Scale (CARS) values. Wilcoxon test for dependent samples. ANOVA test. *p=0.01, **p=0.03, ***p=0.02*

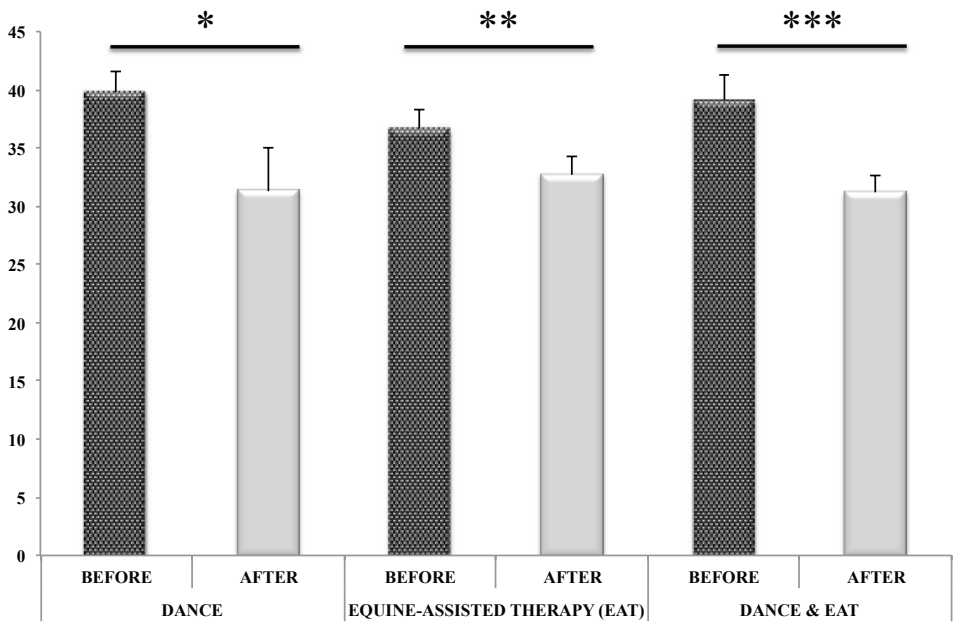


Figure 4. *Pre and post-treatment Functional Indipendence Measure (FIM) values. Wilcoxon test for dependent samples. ANOVA test. *p=0.03*

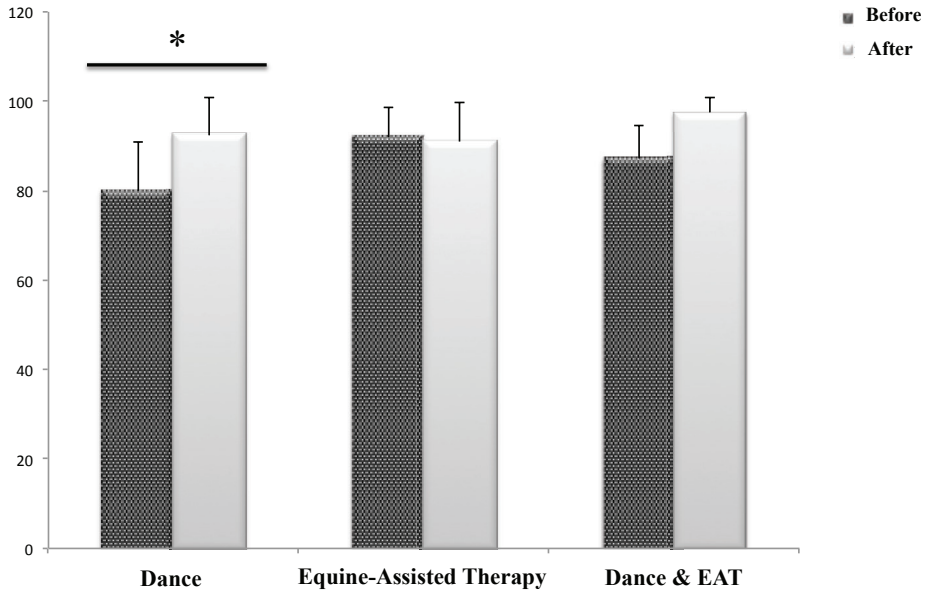
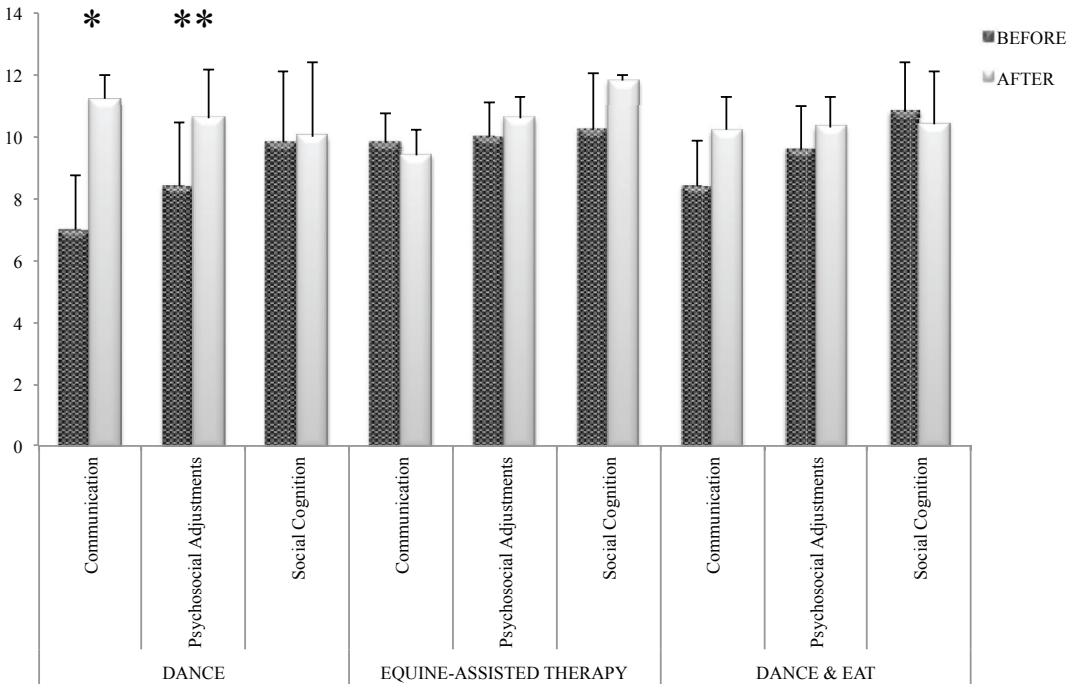


Figure 5. *Pre and post-treatment Communication, Psychosocial Adjustments and Social Cognition domains by Functional Indipendence Measure (FIM). ANOVA test. *p=0.01, **p=0.02*



group; they attended classes and sessions in order to play and observe how the activities were performed.

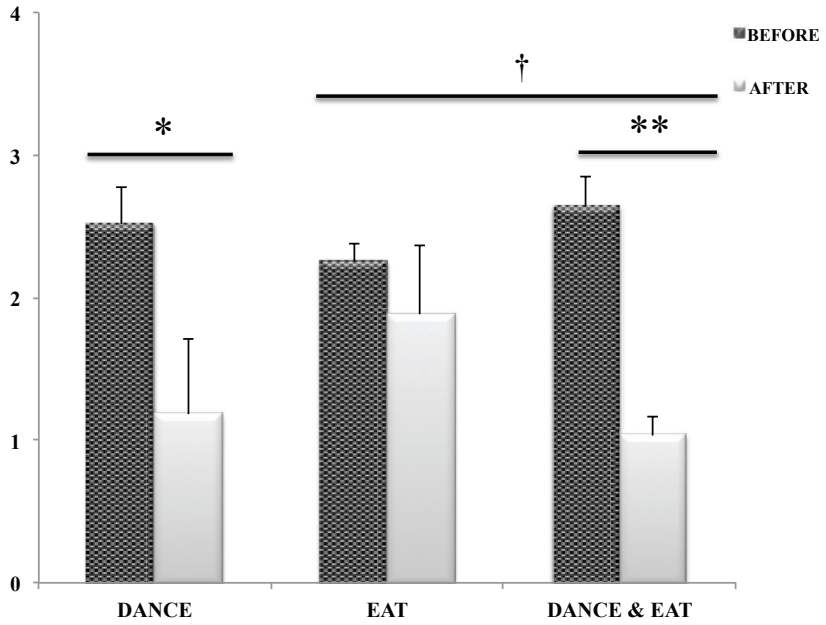
The assessment scales allow to measure ASD presented characteristics, in order to allow diagnosis and monitoring of greater reliability (DuBois et al. 2017, Posar and Visconti 2017), mainly regarding communication and social aspects that substantially influence ASD quality of life.

Social function is seriously affected by ASD and causes severe changes in socialization, communication and cognition areas (Gomes et al. 2015, McDaniel Peters and Wood 2017, Srinivasan et al. 2016). This may be due to a multifactorial etiopathogeny resulting from an interaction between genetic and environmental factors (Bremer et al. 2016, Tordjman et al. 2014).

Whereas ASD clinical presentations show large individual variations, and interfere in different areas of daily living, including social participation (Bhat et al. 2017, Par and Kim 2016). In this way, it is evident the necessity of interventions that provide devices to intervene in ASD communication and social distresses.

According McDaniel Peters and Wood (2017),

Figure 6. *Pre and post-treatment World Health Organization Disability Assessment Schedule, 2.0 version (WHODAS 2.0) values. Wilcoxon test for dependent samples. ANOVA test. *p=0.04, **p=0.0001, †p=0.03*



playful and recreational activities contribute to ASD treatment, especially when performed outdoors or "in group". These scenarios were offered in dance practice and equine-assisted therapy.

Contact and relationship with horse is an activity that is part of rehabilitation process. After all, when it is included in the intervention, it can be considered a significant tool that aids re-educational techniques in order to overcome motor, sensory, cognitive and behavioral deficits. It proposes greater interaction between environment, animal and therapist acquiring better socialization (Borgi et al. 2016, McDaniel Peters and Wood 2017, Petty et al. 2017).

Dance has the capacity to reflect personality in dance movement. Corporal dialogue happens when the body dances can open the possibility of new ways that help the individual to live and to deal with the different and differences (Teixeira-Machado 2015, Teixeira-Machado and DeSantana 2015). Dance influenced functional independence of participants. It was perceptible through proposed actions in dance classes and in public performances. This favored contact with the outside environment, especially with audience applauses. Behavioral changes were substantial for communication, socialization, and self-knowledge.

About the analysis of communication, psychosocial adjustments and social cognition domains by FIM, relevant results were observed in Dance Group. Teixeira-Machado (2015) elucidated that dance allows ASD to seek non-verbal communication that intensifies, and it is expressed by body expressions, manifesting a desire, a will.

In addition, dance leads to knowledge of one own body and its potentialities through expressive, sensitive, sensory, creative, motor and rhythmic activities. In this way, creativity is stimulated, allowing each one to create his own movements, developing greater confidence, respecting the time and the limit of each one (Teixeira-Machado et al. 2017).

These aspects corroborated with study of Teixeira-Machado and DeSantana (2015) in which integration of the individual with external environment proposed by dance influences the socialization process. In this way, it contributed to the insertion of individual with limitations in social contexts. Besides that, findings showed a state of wellbeing, especially in expression limitations.

During dance classes, the evolution of participants regarding communication and social aspects was noticeable. It was evidenced by the relationship and communication improvement with the others. The main gains were visible through interest in dancing, sequence performance sequence and staying on stage during all presentations in public. Findings were reinforced when dance was associated with riding practice.

5. Limitations

Our study was based only on CARS to rate autism. Other evaluation instruments are more judicious than the one used in this study. On the other hand, findings reveal the importance of dance as a source of communication, socialization, and functional independence in ASD scenario. However, the sample was small and the intervention period was short in order to ascertain the benefits that dance can provide in the sensorimotor aspects, and then ascertain if dance can make possible the improvement of the intellectual capacities. Further researches are needed to verify the effects that dance can effectively promote in ASD.

6. Conclusion

This study demonstrated the importance of dance and its association with equine-assisted therapy. Interventions were crucial in disorders of the ASD, especially in social aspects, including communication and functional independence for daily living tasks.

Considering limitations and difficulties, interventions were fundamental and effective for general improvement of the participants, promoting well being, in the sense

of having aroused the affectivity, stereotyped behaviors reduction and social relationship improvement.

At each contact that participants had with others during interventions, changes occurred in communication, interaction, and social participation. The contact with nature, through the practice of riding and all its process of care with the horse, contributed greatly to promote communication and social reciprocity. Dance aroused interest and curiosity, as well as expression and emotion.

These factors were essential in both ASD criteria, social interaction and social communication (Criteria A) and restricted, and repetitive patterns of behavior, interest or activity (Criteria B). Dancing communicates primarily through non-verbal language, and sensory issues were widely evoked in dance performance, reducing fixation patterns by the movement improvisation from the perception of music and body in space-time between itself and others.

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