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Functional performance in autism spectrum disorder: social, sensory interaction and body awareness

Desempenho funcional no transtorno do espectro autista: interação social, sensorial e consciência corporal

Rendimiento funcional en el trastorno del espectro autista: interacción social, sensorial y conciencia corporal

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Objective: to verify the existing relationships in sensory integration, social integration and body awareness in the functional performance of individuals with autism spectrum disorder. **Methods:** systematic review, using the descriptors: "*autism spectrum disorder*", "*learning*" and "*adaptation, psychological*" and the search was carried out in: PubMed/MEDLINE, LILACS, Web off Science, Scopus. The (PRISMA-2020), the Cochrane Handbook scale and the Downs and Black scale were used to check bias. **Results:** 16 articles were considered, and two themes emerged: *Body awareness and balance in the motor learning of ASD children*; *Aspects of sensory interaction and the importance of family participation and social interaction for the functional activity and quality of life of the ASD patient*. Sensory stimuli have interrelationships with sensory self-regulation strategies to facilitate the emission of adaptive responses. Therapies with family support must intervene in an innovative, timely and individualized way, whose deficiencies must be identified as they arise. Quality of life has the impact of relationships with social communication, perception and participation of family members. **Conclusion:** this study suggests the insertion of motor activities associated with reciprocal imitation techniques that promote relationships between the records of sensory information, establishing environmental demands with the participation of the family.
Descriptors: Autism spectrum disorder; Learning; Adaptation, Psychological; Cognition.

Objetivo: verificar as relações existentes na integração sensorial, social e consciência corporal no desempenho funcional do indivíduo com transtorno do espectro autista. **Método:** revisão sistemática, com o uso dos descritores: "*autism spectrum disorder*", "*learning*" e "*adaptation, psychological*" e a busca se deu na: PubMed/MEDLINE, LILACS, Web off Science, Scopus. Foi utilizado o (PRISMA-2020), a escala Cochrane Handbook e a escala Downs e Black para verificação de viés. **Resultados:** considerou-se 16 artigos, e emergiram duas temáticas: *Consciência corporal e o equilíbrio na aprendizagem motora da criança TEA*; *Aspectos da interação sensoriais e a importância da participação da família e interação social para atividade funcional e qualidade de vida do paciente TEA*. Os estímulos sensoriais apresentam inter-relações com as estratégias de autorregulação sensorial para facilitar a emissão de respostas adaptativas. As terapêuticas com suporte familiar devem intervir de forma inovadora, oportuna e individualizada, cujas deficiências devem ser identificadas conforme surjam. Já a qualidade de vida apresenta impacto de relações com a comunicação social, percepção e participação dos familiares. **Conclusão:** este estudo sugere a inserção de atividades motoras associadas às técnicas de imitações recíprocas que propicie as relações entre os registros das informações sensoriais estabelecendo demandas ambientais com a participação da família.
Descritores: Transtorno do espectro autista; Aprendizagem; Adaptação psicológica; Cognição.

Objetivo: verificar la relación entre la integración sensorial, social y la conciencia corporal en el desempeño funcional de individuos con trastorno del espectro autista. **Método:** Revisión sistemática utilizando los descriptores: "*autism spectrum disorder*", "*learning*" y "*adaptation, psychological*" y la búsqueda se realizó en: PubMed/MEDLINE, LILACS, Web off Science, Scopus. Se utilizaron PRISMA-2020, la escala del Manual Cochrane y la escala de Downs y Black para comprobar la existencia de sesgos. **Resultados**: Se consideraron 16 artículos y surgieron dos temas: *Conciencia corporal y equilibrio en el aprendizaje motor del niño con TEA; Aspectos de la interacción sensorial y la importancia de la participación familiar y la interacción social para la actividad funcional y la calidad de vida del paciente con TEA.* Los estímulos sensoriales están interrelacionados con las estrategias de autorregulación sensorial para facilitar respuestas adaptativas. Las terapias con apoyo familiar deben intervenir de forma innovadora, oportuna e individualizada, y las deficiencias deben identificarse a medida que surgen. La calidad de vida se ve afectada por las relaciones con la comunicación social, la percepción y la participación familiar. **Conclusión:** Este estudio sugiere la inclusión de actividades motrices asociadas a técnicas de inmersión recíproca que promuevan relaciones entre el registro de información sensorial y el establecimiento de demandas ambientales con la participación de la familia.
Descriptores: Trastorno del espectro autista; Aprendizaje; Adaptación psicológica; Cognición.

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a topic that has been debated worldwide, and concerns about the progression of the pathology have become frequent[1]. When developing techniques for caring for children with ASD, the educator, family members and therapists will require specific techniques related to this type of special need. However, the family's relationships with the child to maintain quality of life and the family members' anxiety to understand and organize mutual participation became an obstacle to be overcome[2-3]. The impact of associations between mothers' anxious behavior and the family's difficulties in adapting appears to be important in favoring therapeutic processes and the behavior of their children[4].

Professional performance requires not only understanding the presence of subsequent comorbidities, but also the symptomatic and idiopathic factors that result in greater complexity for the health professional to understand the autistic person's ability to establish relationships[5]. The main contributions and limits of these approaches are identified, in a place where the need for integration of different domains and investigations that include both the deficiencies and social skills of individuals with autism is claimed, in the recognition of individual differences in the life of autistic people, and techniques for the singular therapeutic plan (STP).

There are different theoretical postulates within the psychoanalytic, psychosocial and psychomotor approach that propose to explain autism, among them, communication and restricted and repetitive patterns. The development of language derives from the need to communicate with other people. Language is usually the child's first socialization experience, mediated by parents during everyday activities[6]. When a child's language is not functional and interferes with their social adaptation, a pragmatic disorder can be observed[7].

Pragmatic disorders can result in different communication symptoms. In some cases, such as ASD, impairments in communication go beyond social communication, and affect the ability to maintain relationships and demonstrate interest in various topics[7]. When there are severe difficulties in receptive and expressive verbal language, but there is no intellectual deficit, the child must be evaluated to check whether there is a Developmental Language Disorder (DLD)[7].

From previous research to more recent studies, we can see the difficulties in recognizing the rights and dignity of autistic people[8-9]. It is necessary to constantly question dominant power structures and relationships that, in contemporary society, tend to reinforce prejudice and segregation, making resilience actions and the participation of autistic people under conditions of equality in social and political life difficult, in classroom and in the world[8-9]. ASD

intervention should focus on its specific characteristics, empathy processes, executive functioning, namely behavioral regulation, communication and metacognition[10]. In this context, the objective of this study was to verify the existing relationships in sensory integration, social integration and body awareness in the functional performance of individuals with Autism Spectrum Disorder.

METHODS

This is a systematic review, developed with the guidelines and items for Systematic Reviews and Meta-Analyses of PRISMA - 2020[11]. For this work, a protocol was used with the methodological characteristics of the studies, as follows: data from private sources or secondary variables contained in clinical, retrospective, prospective, case control, cohort and cross-sectional trials.

In the inclusion criteria, the following were considered: research carried out with children diagnosed with autism, and which addressed learning and assessment difficulties regarding their behavior, balance and quality of life. For the exclusion criteria: non-relevant scientific articles that addressed other conditions and that were not focused on factors that impacted the behavior and learning of the ASD child. Likewise, aspects that were not focused on: learning, motor skills and concepts about social interaction. Articles with other populations were also excluded.

For this research, data from instrumental validation studies, review studies, books and studies referring to search strategies for the development of systematic reviews were used; however, the data obtained from these were not included in the analysis. Personal articles, editorials, letters, reviews, comments and conference summaries were not considered. For qualitative analysis and synthesis, studies should be fully available online, in English, Portuguese and Spanish.

For the search in the databases, the following were considered: Web of Science, Scopus, PubMed/MEDLINE and Latin American and Caribbean Health Sciences Literature (LILACS). To obtain the keywords, we checked the health sciences descriptors (DeCS) from LILACS. The search was carried out in March and April 2022. The descriptors listed were: "*autism spectrum disorder*", "*learning*" and "*adaptation, psychological*", associated with the Boolean operators "OR" and "AND". Search strategies and descriptors: "*cognition*" OR "*autistic disorder*" OR "*learning*" OR "*adaptation, psychological*"; "*learning*" OR "*cognition*" OR "*adaptation, psychological*" OR "*autistic disorder*"; "*adaptation, psychological*" OR "*cognition*" OR "*autistic disorder*" OR "*learning*"; "*cognition*" AND "*autistic disorder*" AND "*learning*" AND "*adaptation,*

psychological"; "*learning*" AND "*cognition*" AND "*adaptation, psychological*" AND "*autistic disorder*"; "*adaptation, psychological*" AND "*cognition*" AND "*autistic disorder*" AND "*learning*".

The PICO[12] strategy was applied. Population: child patients with autism, subjected to monitoring of their relationships, behaviors and treatments; Intervention: therapies aimed at improving learning, considering aspects related to body awareness, child balance and aspects related to quality of life and family participation; Control: comparative studies on learning and motor behavior in ASD individuals; and Results: guidelines for learning, balance and body awareness along with therapeutic treatments in autistic patients.

The selection was developed by peers following the recommendations of the PRISMA – 2020 consensus and, consecutively, by the PICO[13] strategy. The search was guided by the following question: *What are the main factors involved in the functional learning of children with ASD?*

The search was developed by two independent reviewers and, if there was a disagreement, a third reviewer would establish mediation for the inclusion process, using the pre-established protocol with the initial guidelines and, although there was no year limitation for inclusion, the protocol gave preference for the most recent studies with stronger scientific evidence, advocating the internal validity of research and the guidelines of the Center for Evidence-based Medicine, Oxford, United Kingdom (www.cebm.net), which are similar to the pyramid guidelines by Murad[14].

From the initial selection of publications, added to the chosen bases and proposed criteria, the steps were chosen: identification of duplicated works; reading the descriptors; reading titles; reading abstracts; methodological analysis. Studies that did not present aspects related to the validation system (VS) would be excluded; different population; methods and results have not been elucidated between stretching and its contribution to VS.

Also, studies should contain physiological and biomechanical aspects and the strategies used by researchers. Consecutively, a keyword co-citation analysis was developed. After applying the article selection process for systematic reviews, the resulting works were then subjected to bibliographic analysis of descriptors, in order to evaluate the frequency and interaction of descriptors present in the selected articles. In this way, the analysis of keywords allowed a retrospective evaluation of the quality of the selection process of the articles used.

The data were organized in a descriptive way in the text, with identification of the countries where the qualitative selection studies were carried out, as well as the construction of a table on the methodological characteristics of the studies, with statistics and related equipment and using different types of clinical studies.

In clinical trial studies, the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions (Version 5.1.0)[15] were taken into account as a tool for checking bias in table 8.5.d (Cochrane Handbook of Systematic Reviews of Interventions, version 5.1.0, guidelines)[15]. Studies that reached "≥4" domains in the table with a low level of bias were considered satisfactory and possible for allocation. For a study to be selected, it must present a low risk of bias, preferably in domains six and seven, that is, superiority in the low level of bias in four domains or more, as long as it included the sixth and seventh domains. Studies that achieved "low risk of bias" in only one, two or three "≤3" domains were considered unsatisfactory for this research.

The level of bias in other studies, such as cohort, case-control and cross-sectional studies, was assessed using an adaptation of the Downs & Black (1998)[16] scales. In these cases, the score was allocated as follows: a research had to reach at least 13 points to be selected. However, the maximum score for case-control studies was set at 28 points according to the scale criteria, and a maximum of 22 points for both cohort and cross-sectional studies.

RESULTS

The initial search resulted in 403 articles identified on the topic of interest. After removing 164 duplicate articles, 239 articles in Portuguese, English and Spanish were obtained for analysis. A comprehensive analysis of title and abstract eliminated a further 117 articles, resulting in 122 articles, and subsequently, 94 studies were excluded using the PICO strategy, making a total of 28 eligible studies in the first stage (Figure 1).

In the second stage, all 28 articles were read in full, and 12 were excluded from the analysis. Of these, five studies were excluded due to lack of data to identify strategies used for learning and children with autism; three by evaluating others outcomes and one investigation by presenting selection bias, generating confusion in outcomes that could not be related to autism, hindering motor and intellectual learning. And three because their data were insufficient to evaluate the relationships between motor learning in children with ASD and/or factors related to the child's quality of life. Thus, 16 productions were considered part of the study (Figure 1).

In turn, Figure 2 presents the interaction between descriptors present in the selected articles, interaction analysis of the most relevant keywords.

Figure 1. Flowchart of the selection process activities through the search diagram adapted to the PRISMA 202011 checklist with adapted design. Florianópolis/SC, Brazil, 2023.

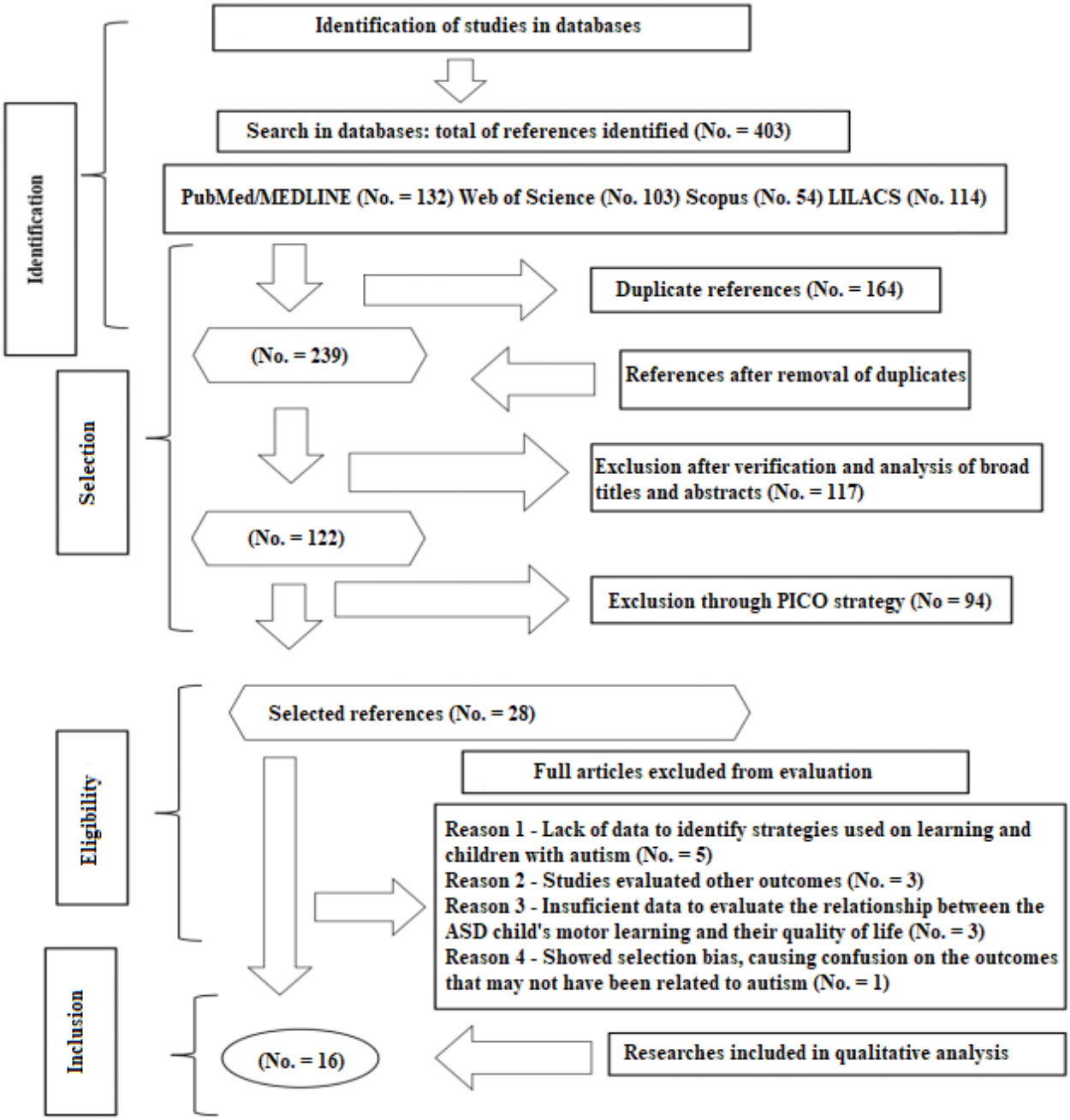
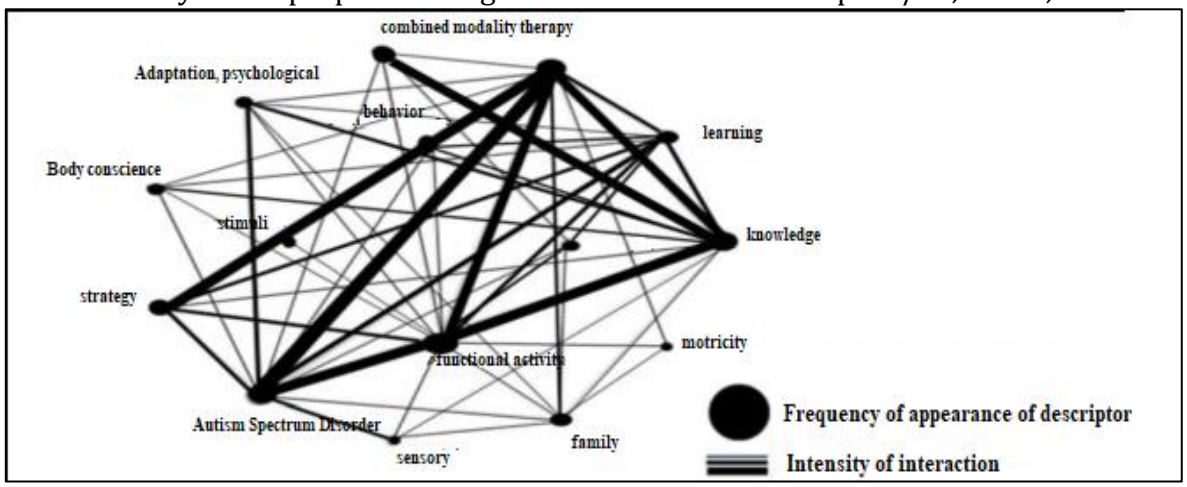


Figure 2. Interaction of descriptors present in selected articles, interaction analysis of the most relevant keywords prepared using Sitkis Software. Florianópolis/SC, Brazil, 2023.



The present systematic review obtained, upon inclusion, 16 scientific studies for analysis, of which nine (56.2%) were experimental studies, four (25%) were cohort studies, and three (18.75%) were cross-sectional studies. As for the country where the study was developed, nine (56.25%) were developed in the United States, four (25%) in Brazil, one (6.25%) in Italy, one (6.25%) in Japan and one (6.25%) in Libya (Table 1).

Table 1. General characteristics of the included studies. Florianópolis/SC, 2023. Florianópolis/SC, Brazil, 2023.

Author/year	Sample number	Country	Type of research*
Yeargin-allsopp et al.[2] (2003)	987	United States	ES
Zablotsky et al.[3] (2012)	1,110	United States	CS
Misquiatti et al.[4] (2015)	20	Brazil	CSC
Hage, et al.[7] (2022)	40	Brazil	CSC
Richa et al.[19] (2020)	818	Libya	CSC
Nowell et al.[21] (2019)	17	United States	ES
Ishizuka et al.[25] (2021)	06	Japan	ES
Hilton et al.[27] (2012)	144	United States	CS
Rudelli et al.[33] (2021)	63	Italy	CS
Dunn et al. [34] (2012)	20	United States	ES
Bradshaw et al.[35] (2022)	124	United States	ES
Blume et al.[38] (2020)	189	United States	CS
Ingersoll[41] (2010)	21	United States	ES
Krüger et al.[42] (2019)	10	Brazil	ES
Balestro et al.[43] (2019)	62	Brazil	ES
Macdonald et al.[44] (2019)	72	United States	ES

*_**Abbreviations**_: **ES** – Experimental study; **CS** – Cohort Study; **CSC** – Cross-sectional cohort.

Regarding the scores on the Downs and Black[16] scale adapted for observational studies, two studies reached 17 points, three studies reached 16 points and four reached 13 points (Table 2).

Table 2. Characteristics of the observational studies included in the synthesis, based on the adaptation of the Downs and Black[16] scale bias checking tool. Florianópolis/SC, Brazil, 2023.

Authors	Downs e Black scale PO /MS*	FR (%)
Yeargin-allsopp et al.[2]	16/22	72.7
Zablotsky et al.[3]	13/22	59.1
Misquiatti et al.[4]	16/22	72.7
Hage, et al.[7]	13/22	59.1
Richa et al.[19]	13/22	59.1
Hilton et al.[27]	17/22	77.3
Rudelli et al.[33]	16/22	72.7
Blume et al.[38]	17/22	77.3
Ingersoll [41]	13/22	59.1

* ***Abbreviations:*** PO – Points obtained, MS - Maximum score.

Table 3 presents the verification of bias by the Cochrane Manual[15], of which four studies reached 5 points and three reached 4 points.

Table 3. Characteristics of the included clinical trial studies, clinical trials and the number of domains found from the adaptation of the bias check tool from the Cochrane Manual. Florianópolis/SC, Brazil, 2023.

Autores	Cochrane Handbook DF/ MS	Relative frequency (%)
Nowell et al.[21]	5/7	71.4
Ishizuka et al.[25]	4/7	57.1
Dunn et al. [34]	5/7	71.4
Bradshaw et al. [35]	4/7	57.1
Krüger et al.[42]	5/7	71.4
Balestro et al.[43]	4/7	57.1
Macdonald et al. [44]	5/7	71.4

Abbreviations: DF - Domain found; MS– Maximum score

DISCUSSION

From the material collected, two themes were established to be discussed in accordance with the main objective of the study, namely:

- *Body awareness and balance in the motor learning of ASD children*;

- *Aspects of sensory interaction and the importance of family participation and social interaction for the functional activity and quality of life of the ASD patient*.

Body awareness and balance in the motor learning of ASD children

The development of the motor system is essential for an individual to engage with the environment. Neurodevelopmental disorders (NDDs) are a heterogeneous group of conditions characterized by delays or abnormalities in a variety of developmental domains, including delays in motor skills [Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5)[17]].

ASD has become a public health problem, with a strong social, economic and family impact. As we begin to identify specific motor impairments in ASD and the timing of these

impairments' emergence, we can begin to develop timely, individualized interventions and community services that support these individuals and improve overall neurodevelopmental outcomes and long-term functioning[18]. The positive results highlight the critical need to develop evidence-based motor and physical activity interventions for individuals with ASD[18].

A study found results suggesting a risk of ASD in 24.7% of children aged 16 to 48 months who were initially screened on the M-CHAT-R scale. Depending on the availability of clinical confirmation, this initial rate was used to estimate a higher and lower range of ASD prevalence[19]. In the "best case scenario", only confirmed cases of ASD would be included, leading to a likely underestimated prevalence of 49/10,000. In the "worst case scenario", high-risk children and a proportion of moderate-risk children[19].

The diversity of behavioral patterns among ASD people indicates the importance of tailoring intervention individually. Therapists should be aware of gender-related social communication expressions in adults with ASD in relation to therapy problems and propositions. However, evidence increasingly shows that parental behavior plays a role in the development of children with ASD, similar to typically developing (TD) children[20].

Deficits in social communication skills and a restricted and repetitive repertoire of behaviors appear early in the child's development[20]. Results indicate that the intervention is effective in teaching social communication and knowledge of the concept of self-regulation for children with ASD and their parents[21].

Children with ASD present more significant social and pragmatic impairments than children with TMD[22]. Parents and therapists reported deficits in both verbal and non-verbal communicative skills of ASD children. In turn, both children with ASD and those with DLD present more social pragmatic difficulties than children with TD[7].

Also, the perception of parents and teachers about the social pragmatic skills of the children they know is very similar, regardless of the diagnosis[7]. Results outline significant areas of importance for improving the middle school transition process for children with ASD, including the need for individualized transition planning mixed with attention to the core issues of friendships, teacher emotional support, familiarization with school structures, and focus. in the positive aspects of the transition to alleviate anxieties[23].

Professionals should be encouraged to consider movement skills assessments as a routine investigation for children with ASD[24]. Imitation with social and learning functions in children with Autism Spectrum Disorder - Intellectual Disability (ASD-ID) with difficulties in developing social interactions are important[25]. Imitation plays a crucial role in the development of social communication and is a skill that is often lacking in children with ASD and co-occurring

intellectual disabilities. Therefore, contingent imitation (CI) results in increased social gaze, an imitation cue for children with ASD[25].

In research[24,25] on the reciprocal imitation training (RIT) intervention, which included CI, demonstrated an increase in the frequency of imitation. It was found that little is known about the effects of CI intervention on the accuracy of motor and vocal imitation in children with ASD-ID. Results suggest that CI intervention tends to improve social gaze and sustained imitation interactions (SI) using modeling and contingent responses can increase the accuracy of various types of imitation in children with ASD-ID, even in the absence of stimulation[24,25].

Qualitative and quantitative abnormalities affect not only the areas of social interaction, but also communication, areas of behavior, social skills and improved language areas that can facilitate participation in activities that lead to fine and gross motor strength and dexterity[26,27]. The animal-assisted therapy (AAT) program was a promising intervention to increase confidence and self-esteem in adults with ASD, and the results on the effects of AAT revealed a more upright and confident body posture in the last session, compared to the first session[28].

In children with TD, parental sensitivity and synchronization improve development across multiple developmental domains. Parents play an important role in many interventions, from carrying out interventions that improved parents' responsiveness to the baby's cues and serving as supporting coaches and co-therapists[20].

Mixed results were observed for the correlation between teaching experience and teaching self-efficacy for those working with students with ASD. However, although no correlation was evident, other positive improvements have been identified in other studies[29-31].

There seems to be great difficulty in understanding ASD children, as well as identifying and understanding their antecedent experiences. The ASD child cannot always provide sufficient mastery experience to increase the educator's perceptions of self-efficacy[32], thus, self-efficacy of care is advocated and not the burden of care. However, the ASD child's challenging behavior seems to be more associated with the parent's caregiving burden than their caregiving self-efficacy. Social support has shown positive correlations with satisfaction, care and self-efficacy of care and negative correlations with the burden of care[33].

Improvements were identified in intervention sessions that involved reflective discussion with parents to support educators and therapists in identifying strategies to achieve their goals and subsequently make joint plans for the next week[33]. The study measured child participation (Canadian Occupational Performance Measure, Goal Attainment Scale) and parental competence (Parenting Sense of Competence Scale, Parental Stress Scale). The results

demonstrated that parents felt more competent and children significantly increased their participation in everyday life, suggesting that this approach can have a positive impact on an effective occupational therapy intervention[33].

The reason for starting interventions before their first birthday has become relevant, as babies with ASD exhibit fewer socio-communicative behaviors and make less gains during this period[34,35]. Therefore, early intervention that occurs mid-transition to symbolic communication tends to capitalize on existing communicative skills.

Likewise, the joint involvement of parents is important, as it can enrich the linguistic environment and can help change the developmental trajectories of babies with ASD[34,35]. Among others, targeting skills remain consistently low and are a growing gap, which may result in a protective effect, increasing resilience and improving developmental outcomes for these children.

Aspects of sensory interaction and the importance of family participation and social interaction for the functional activity and quality of life of the ASD patient

The purpose of neurological processing for the organization of bodily sensations and the external environment is to transmit adaptive responses by the subject[35]. The existence of specialized primary, secondary and tertiary subareas, both in the sensory cortex and in the motor cortex, demonstrates the organization of synaptic information that flows to the central nervous system through a series of relay stations[36]. Multisensory neurons from secondary and tertiary areas, and associative neurons, play an organizing and integrating role in the functioning of more specific areas. In the last instance of this hierarchical process, the meaning and sense of unity definitely begins to be established, which comes from information from the second functional unit[37].

During childhood, the behavior of children with a low sensory threshold tends to detect lower stimuli[34]. Individuals' behavior, especially during childhood, is strongly influenced by their sensory processing patterns[34.] Children with a low sensory threshold, that is, those who detect stimuli more slowly, and who do not try to neutralize them, often cannot perceive sensory stimuli from the environment and, therefore, can be labeled as inattentive. Furthermore, difficulties in detecting internal proprioceptive input can be perceived as clumsiness[34]. The same happens with communication skills and the processes of transitional neurocognitive and motor relationships when it comes to social interactions[38].

Sensory information is received in the external environment, and it is interpreted, recorded, organized and modulated in different environmental demands. Research in Kansas City, USA, described the associations between the neurological threshold and self-regulation

methods for issuing adaptive techniques in children, taking into account the intensity of these stimuli and the relationships with the child's high or low neurological threshold for this receptivity of information[34]. Among others, self-regulation in passive strategies for children that do not act against unpleasant stimuli and active strategies for children control the amount and type of sensory input[34].

Therapies must integrate the sensory aspects of the environment and the hypo and hypersensitivity to sensory stimuli that are perceptible through the main senses related to the perception of the internal and external environment. This conception requires a better understanding of specific aspects and/or stimuli that present a reduced or increased intensity, such as: the proprioceptive, thermoceptive, interoceptive, vestibular and nociceptive senses[39].

Prior planning of pedagogical, recreational and motor activities seems to be fundamental, since understanding the daily activities of these children allows not only to establish strategies, but to understand the positive aspects in the interaction between the individual and the contextual factors relating to the structure of the body, its functionality and the means to establish better social interaction.

Training methods have shown significant differences in the acquisition of social interactions and family integration. The TIR method showed improvements in language and social development with the use of this technique[40-44]. Individual treatments were similar for ASD children, since the functional communication-checklist (PCF-C) profile increased the occurrence of gestural and verbal means in ASD children[39].

Even though the practice of exercises with rhythmic activities is based on conceptions related to positive aspects of treatment and the patient's quality of life, different research highlights that individuals with ASD present reduced levels in the execution of motor activities and, in their idiopathic symptoms, that make their interrelationships difficult. Thus, rhythmic activity did not indicate differences in social interaction in ASD children ($p > 0.01$)[40,41,44].

Another issue is the sensory predictors to be considered and the possible domains affected in the process of relationships between a child's sensory profile and the acquisition of their motor skills since birth. These aspects must be analyzed, such as: the adequacy of gross and fine motor toys, structuring of physical space inside homes and cultural opportunities for family members[45]. Regarding the parents' concern, there seems to be no prevalence of guilt on their part, in the sense of losing control, feelings of guilt, sadness or failure, although there is an inevitable concern that lasts throughout life on the part of the main people involved[46].

Interviews with parents and volunteers, responses to questionnaires, the Parent Semistructured Interview Guide (PSSIG) and the Volunteer Open-Ended Questionnaires

(VOEQ) indicated significant changes in the general level of social interaction at the end of the program of physical activity for 12 weeks[47]. Therefore, there are certain social skills (eye contact, group participation and building relationships with teachers and participants) that presented significant outcomes in relation to communication and the results revealed a general improvement for the experimental group in relation to the control group[47]. These results were observed in the frequency of reactions from peers, teachers, and greetings from volunteers that reflected the perspectives expressed by both parents and volunteers.

CONCLUSION

The child's routine must be worked on with activities that enable learning through sensory stimuli with imitation strategies. The development of the ASD child's motor skills facilitates their involvement in environmental demands. In this way, the sensory stimulus must be interrelated to sensory self-regulation strategies to consecutively emit adaptive responses.

Therapies with family support must intervene in an innovative, timely and individualized way, whose deficiencies must be identified as they arise. Quality of life seems to depend on social communication, as well as the need for family members' perception and participation. Therefore, the present study suggests, for new contemporary studies, the insertion of motor activities associated with reciprocal imitation techniques, which promote relationships between the records of sensory information and its use in different environmental demands with the participation of the family.

Considering the limitations of this research, challenges in the analysis are highlighted due to the scarcity of observational studies that met the quality criteria required for the assessment of bias. This shortage is especially pronounced due to the propensity for bias in research investigating relationships between improvements in intellectual and social behavior and strategies involving physical activity and motor action.

Furthermore, there were difficulties in finding studies that addressed the triad involving therapist, child with ASD and family; as well as on the availability of systematic information that could clarify specific variables related to psychological and emotional functioning in the absence of family participation.

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