Trends
in Psychiatry and Psychotherapy

JOURNAL ARTICLE PRE-PROOF
(as accepted)

Original Article

Emotion Comprehension and Socio-cognitive Skills in Children with High Functioning Autism Spectrum Disorders

Vitoria Santos Santana, Josemar Marchezan, Denise Bisolo Scheibe, Joana Bücker

Emotion Comprehension and Socio-cognitive Skills in Children with High Functioning Autism Spectrum Disorders

Running Title: Emotion in Autism Spectrum Disorder

Vitoria Santos Santana[1], Josemar Marchezan[2], Denise Bisolo Scheibe[1], Joana Bücker[1]

[1]Programa de Pós-Graduação de Ciências Médicas, Universidade do Vale do Taquari (UNIVATES), Lajeado (RS) - Brasil
[2]Unidade de Neurologia Infantil, Serviço de Pediatria, Hospital de Clínicas de Porto Alegre (HCPA), Porto Alegre (RS) - Brasil

Corresponding Author:

Joana Bücker

Email: joana.bucker@gmail.com

Telephone Number: +55 51 996636903

ABSTRACT

Background and objectives: This study aimed to compare socio-cognitive skills and emotion comprehension between children with Autism Spectrum Disorder (ASD) and children with neurotypical development. Methods: This quantitative, cross-sectional, controlled study involved 19 children in each group, matched by age (6–12 years) and sex. The assessments examined cognitive aspects (Intelligence Quotient was assessed using the Vocabulary and Matrix Reasoning subtests; working memory using the digit span and letter-number sequencing subtests; attention using the Continuous Performance Test - Identical Pairs; and executive functions using the Trail Making Test), social functions (Children's Social Skills, Behavior Problems, and Academic Competence Inventory), and emotion comprehension (language was assessed using the *Strange Stories* Test; emotional facial expressions using the digital emotion comprehension test; emotional/affective prosody using the *Profiling Elements of Prosody in Speech-Communication* - Brazilian Portuguese adapted version). Results: The group with ASD exhibited better performance in executive functions

(p=0.02). However, they lagged the control group in social skills (p=0.04), behavior problems (p=0.03), and emotion comprehension (language, facial expressions, and prosody) (all p<0.05). Conclusion: The findings indicate that children with ASD have diminished performance in social skills and emotion comprehension compared to children with neurotypical development. Therefore, the development of technologies and/or therapeutic interventions that address these deficits among children with ASD is recommended.

1. INTRODUCTION

Autistic Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in communication and social interaction. Furthermore, ASD includes the presence of stereotypes, restricted interests, and repetitive behaviors[1] that first manifest usually during early childhood, including various emotional, cognitive, motor, and sensory symptoms[2]. Although its etiology is unknown, multifactorial causes, such as genetic factors, gestational risks, and environmental risks, may affect an individual's functional aspects[1,2].

Cognitive performance in individuals with ASD is not homogeneous and varies based on the severity of their symptoms[3,4]. Furthermore, factors, such as average intelligence quotient (IQ) and the development of language at an expected age, serve as prognostic indicators, which suggest a higher likelihood of development within the typical range[2,5]. Intellectual functioning is a crucial factor in diagnosing High Functioning ASD and is used for differential diagnosis[6].

Some studies indicated that the nuances of cognitive development in ASD influenced social and communicative skills, particularly the recognition and management of emotions. In ASD, emotion comprehension directly impacted interpersonal interactions[7–9]. Even for those with ASD with intact cognitive functions, grasping and understanding emotions could pose a considerable challenge. The ability to discern emotions – both one's own and those of others – played an important role in behavior regulation and enhanced environmental perception and decision-making processes[10]. Studies established that difficulties in maintaining eye contact impaired the recognition and management of emotions[11]. This was especially true concerning

understanding certain emotional facial expressions and the assessment of facial cues related to emotion[12,13]. Although there were variation among studies that assessed differences in facial expressiveness between individuals with neurodivergent and neurotypical development, emotional facial expressions exhibited by individuals diagnosed with ASD were less precise than those of individuals with neurotypical development[12,14,15]. Furthermore, prosody was important in the context of ASD. Some studies suggest that individuals with ASD often faced challenges in both understanding and producing emotional prosody[16–18].

Few studies have examined emotional prosody, particularly in children with ASD. This is due to the unique characteristics of neurodevelopment and rare occurrence of the disorder in the absence of associated intellectual disability[1,19]. Consequently, the significance and importance of this study for the pediatric population were highlighted. This study aimed to compare emotion comprehension and socio-cognitive skills between children diagnosed with High Functioning Autism Spectrum Disorder (ASD) (without an associated intellectual deficit) who could communicate orally and children with neurotypical development. Children with high Functioning ASD will exhibit significantly different socio-cognitive skills and emotion comprehension abilities compared to children with neurotypical development. Specifically, it is expected that children with ASD will demonstrate stronger executive functions but will have greater difficulties in social skills, behavior problems, and emotion comprehension, including recognizing and interpreting emotional facial expressions and prosody.

2. METHODOLOGY

2.1. Characterization of the Study

This cross-sectional, quantitative study adhered to the guidelines set in the Declaration of Helsinki and its future amendments that pertained to ethical principles, legitimacy of information, and data privacy and confidentiality. The project was approved by the relevant Research Ethics Committee.

2.2. Participants

Children aged 6–12 years diagnosed with ASD according to the Statistical Manual of Mental Disorders Fifth Edition (DSM-V), with diagnoses confirmed by the investigator, were included. For the control group, children with neurotypical development who were verbal and had school affiliations within the same age range were included. These two groups were age- and sex-matched. Exclusion criteria for both groups included the presence of an intellectual deficit, diagnosis of another neurodevelopmental disorder, any associated neuropsychiatric diagnosis, and lack of oral communication. The initial evaluation involved 65 volunteers, with 19 in the study group (children with ASD) and 19 in the control group (neurotypical development). Other 27 were excluded due to an IQ of less than 70 (21 individuals), age and sex mismatch (five female volunteers), and suspicion of a possible neuropsychiatric disorder in one male participant. Consequently, the sample was determined for convenience, sourced from the community and publicized through social media, public education system, and basic health units.

2.3. Assessment Instruments

Data were collected in-person from each child. Consent was obtained from the parents or guardians and participants via a signed Informed Consent Form (ICF) and Informed Assent Form (IAF). A sociodemographic questionnaire was presented to the parents or guardians, and the participants were directed to the assessments. These assessments were conducted by qualified psychologists, psychology students who received appropriate training, and a speech therapist familiar with the assessment tools. See table 1 for the assessment tools.

Tables: Table 1. Assessment tools

Assessment tools	Purpose
Wechsler Abbreviated Intelligence Scale (WASI)[20]	Assessment of intelligence; measurement of both verbal and non-verbal aspects; utilized as a screening tool for estimating IQ.
Continuous Performance Test – Identical Pairs (CPT-IP)[21]	Assesses sustained attention; records response accuracy, omissions, and reaction times.
Trail Making Test (TMT) [22]	Evaluates executive functions, cognitive flexibility, inhibition, attention, and processing speed.
Digits Subtest of the Wechsler Intelligence Scale for Children (WISC-IV)[23]	Assesses attention and working memory through sequence repetition tasks.
Numbers and Letters Sequence Subtest of the Wechsler Intelligence Scale for Children (WISC-IV)[23]	Measures working memory; requires participants to repeat and arrange verbal stimuli.
Children's Social Skills, Behavior Problems, and Academic Competence Inventory (SSRS)[24]	Assesses children's social skills, behavior problems, and academic competence through parent/guardian input.
Strange Stories Test [25]	Assesses oral language comprehension and understanding of various emotional aspects.
Test of Emotion Comprehension (TEC Digital)[26]	Evaluates comprehension of emotions across nine components, including facial expression recognition and emotion regulation.
Profiling Elements of Prosody in Speech-Communication (PEPS-C BR)[27]	Assesses receptive emotional prosody, testing the ability to receive and understand emotions through speech.

2.4. Statistical Analysis

A Shapiro-Wilk test was used to assess normality. A chi-squared test was used to compare categorical variables for socio-demographic and clinical differences between the groups. Furthermore, a t-test was used to compare the continuous parametric variables. A Mann-Whitney U test and Wilcoxon signed-rank test were used to analyze non-parametric variables. Descriptive data were presented as either mean and standard deviation (MD ± SD) or median and interquartile range (Median: 1st quartile – 3rd quartile), based on the data's normality. A P-value of <0.05 (two-tailed) was considered statistically significant. However, for tests related to emotion comprehension, a P-value of <0.0013 was considered significant, based on Bonferroni's correction (0.05/No. of tests) to minimize the chance of false-positive results. All statistical analyses were conducted using the IBM SPSS Statistics version 25.0.

3. RESULTS

A total of 68.4% of children with atypical development were undergoing drug treatment, while no typical children were on such treatment. Every participant with ASD received some form of non-pharmacological treatment, including speech therapy (26.3%), occupational therapy (31.5%), psychotherapy (89.5%), and complementary therapies (78.9%). Of these, 94.7% received treatment weekly, and 5.3% fortnightly. Only 10.5% of neurotypical participants were undergoing psychotherapy, either weekly or fortnightly.

Regarding sociodemographic data (Table 2), parents of children with neurotypical development (from the evaluated population) had a lower educational level (*p*=0.002). For other sociodemographic variables (sex, age, family income, and educational level of the participants), no significant differences were observed between the groups.

Table 2. Participants' sociodemographic data.

Variables	ASD (n= 19) No. (Percentile)	Control (n= 19) No. (Percentile)	Statistic	P-value
Male Sex, n (%)	17 (89.5%)	17 (89.5%)	X^2(df)= 1 (0)	1
Age	9 (7 — 10)*	9 (7 — 10)*	z= -0.26	0.79
Ethnicity, n (%)	19 (100%)	19 (100%)	X^2 (df)= 2.11 (2)	0.34
White	15 (78.9%)	11 (57.9%)		
Brown	3 (15.8%)	5 (26.3%)		
Black	1 (5.3%)	3 (15.8%)		
Educational Level, n (%)	19 (100%)	19 (100%)	X^2 (df)= 1.97 (6)	0.92
1st grade	2 (10.5%)	1 (5.3%)		
2nd grade	5 (26.3%)	5 (26.3%)		
3rd grade	2 (10.5%)	3 (15.8%)		
4th grade	4 (21.1%)	5 (26.3%)		
5th grade	3 (15.8%)	1 (5.3%)		
6th grade	2 (10.5%)	2 (10.5%)		
7th grade	1 (5.3%)	2 (10.5%)		
Educational level of adults in the family - in years of study	15 (11 – 17)*	11 (9 – 15)*	z= -3.0	**0.002**
Number of family members	4 (3 – 4)*	4 (4 – 5)*	z= -1.85	0.06
Family income - in reais (R$)	5000 (4000 –7000)*	3500 (2000 – 8000)*	z= -0.62	0.53

*Note***: * Interquartile range:** Median (1st range – 3rd range).

Regarding executive functions, children with ASD performed better on the TMT-B and made fewer errors (*p*=0.02) than children with neurotypical development (Table 3). No significant differences were observed in the other variables.

Table 3. Data on assessments of cognitive aspects

Variables	ASD (n= 19) M ± SD	Control (n= 19) M ± SD	Statistic	P-value
Digits - T Score	7.53 ± 4.23	9.26 ± 3.14	t (df) = -1.33 (18)	0.20
Sequence of numbers and letters - Weighted score	7.89 ± 2.54	9.26 ± 4.21	t (df) = -1.12 (17)	0.28
IQ	95 (83 – 109)*	91 (84 – 114)*	z= -0.24	0.811
CPT - IP Total Score	0.21 (0 – 0.69)*	0.52 (0.21 – 1.12)*	z= -1.4	0.12
TMT-A (time in seconds)	60 (44 – 90)*	61 (48 – 72)*	z= -0.42	0.67
TMT-A (errors)	1 (0 – 3)*	1 (0 – 4)*	z= -0.08	0.93
TMT-B (time in seconds)	157 (113.5 – 280.5)*	300 (130 – 300)*	z= -1.42	0.15
TMT-B (errors)	2 (0.5 – 8)*	15 (2 – 32)*	z= -2.33	**0.02**

Note: * **Interquartile range:** Median (1st range – 3rd range). **Digits:** Subtest of the Wechsler Abbreviated Scale of Intelligence; **Sequence of numbers and letters:** Subtest of the Wechsler Intelligence Scale for Children; **IQ**: intelligence quotient; **CPT-IP**: Continuous Performance Test – Identical Pairs; **TMB-A**: Trail Making Test - Test A; **TMB-B**: Trail Making Test - Test B.

Regarding social skills, there was a significant difference only in social resourcefulness (*p*=0.045) between the groups (Table 4). There was also a statistical significance in the variable Behavior Problems - Percentile (*p*=0.03) (Table 4). For both variables, the ASD group performed worse.

Table 4. Data on assessments of social skills and behavior problems.

Variables	ASD (n= 19)	Control (n= 19)	Statistic	P-value
	interquartile range	interquartile range		
SSRS Social Skills - Social Resourcefulness	5 (3 – 6)	6 (4 – 6)	z= -2	**0.045**
SSRS Social Skills - Percentile	35 (25 – 65)	65 (40 – 75)	z= -1.87	0.06
SSRS Behavior Problems – Percentile	52.37 ± 19.32*	40.68 ± 14.64*	t (df)= 2.24 (18)	**0.03**

Note: * **M ± SD:** mean and standard deviation; **SSRS**: Children's Social Skills, Behavior Problems, and Academic Competence Inventory.

Significant differences were observed in the assessment of understanding emotion from facial expressions (Table 5), both in the Digital TEC variable - Raw Score (**p=0.006**) and percentile (**p=0.006**). The *Strange Stories* Test also demonstrated statistical significance (**p=0.001**). In the assessment of understanding emotional prosody via the Affect Receiving Ability Test of the PEPS-C BR (**p=0.001**) (Table 5), differences were observed between the groups. The ASD group had lower scores and means in all these parameters.

Table 5. Data on the assessment of emotion comprehension.

Variables	ASD (n= 19)	Control (n= 19)	Statistic	P-value
	M ± SD	M ± SD		
TEC Digital - Raw Score	22.05 ± 4.66	25.26 ± 1.44	t (df)= -3.14 (18)	**0.006**
TEC Digital - Percentile	78.75 ± 16.64	90.22 ± 5.16	t (df)= -3.14 (18)	**0.006**
Strange Stories Test - Total Score	17 (14 – 20)*	22 (20 – 23)*	z= -3.27	**0.001**
PEPSC-BR (Affect receiving ability test)	12 (10 – 14)*	15 (12 – 16)*	z= -2.52	**0.01**

Overall score

Note: *** Interquartile range:** Median (1st range – 3rd range). **TEC Digital:** Test of Emotion Comprehension; **PEPS-C BR:** Profiling Elements of Prosody in Speech-Communication (Brazilian Portuguese adapted version).

4. DISCUSSION

This study examined socio-cognitive aspects and emotion comprehension in pediatric patients with High Functioning ASD compared to a group with neurotypical development. This focus differentiated our research from previously studies as they did not explore this specific aspect[8,15,28,29]. The significance of this assessment lay in the clinical domain, as cognitive development was potentially associated with social and communicative skills. Although cognitive functions were preserved in High Functioning individuals, their ability to identify, control, and understand emotions could be compromised. Such impairments directly influenced social interactions[7–9], as recognizing emotions – both one's own and those of others – played an important role in decision-making process, environmental perception, and behavioral regulation[10]. Additionally, emotional facial expressions exhibited by individuals diagnosed with ASD were less precise than those of individuals with neurotypical development[12,14,15]. This difference could be crucial in emotion perception and comprehension.

In the assessment of cognitive aspects, only the executive function assessment (TMT - B errors) indicated differences, showing that children with ASD performed better than the control group. This test incorporated numbers and letters, which were often areas of hyperfocus for children with ASD, which frequently manifested as hyperlexia[30,31]. Hyperfocus is a phenomenon where an individual becomes entirely engrossed in a task, to the extent that they disregard or completely "disconnect" from everything else[32]. In this study, the ASD group made fewer errors than the control group in the TMT-B test. This could be attributed to the hyperfocus phenomenon, which channeled attention towards areas of interest for most children with ASD, coupled with a potential proficiency with letters and numbers[30]. Concerning social skills and behavior problems, the data in this study aligned with previous research that suggested that individuals with ASD struggled with communication processes and interpersonal interactions[6]. Challenges related to social

resourcefulness and behavior problems in ASD were associated with deficits in discerning intentions, needs, and emotions of others. This could be detected through tests that assessed the Theory of Mind[6,32,33], which involved the capability to understand, visualize, and interpret the mental states of others via meta-representation and metacognition[6,32,33]. Our findings supported the results of a previous study[29] that involved an adult population diagnosed with High-Functioning Autism Spectrum Disorder (ASD). This earlier study demonstrated that while cognitive and social skills were maintained, there was a decline in understanding emotional facial expressions and differences in the reproduction of prosody (despite a good understanding of its emotional content). Furthermore, prosody was important in the context of ASD, as some studies suggested that individuals with ASD often faced challenges in both understanding and producing emotional prosody[16–18].

In the assessment of emotion comprehension through language skills via the *Strange Stories* Test, children with atypical development faced more challenges, especially when it came to figures of speech, jokes, and the distinction between appearance and reality. These findings were consistent with earlier studies that showed that children diagnosed with ASD struggled with language skills, which included syntax[8,34]. Such impairment was anticipated and could be attributed to the nature of the test used, as the *Strange Stories* Test required understanding of social contexts[19,25], a known area of deficit in ASD.

A decrease in the mean score for the Digital TEC related to task analysis was observed both in raw scores and percentiles within the ASD group, which represented the relationship between imagination and language[12]. The limited ability or difficulty in imagining was connected to challenges in perceiving and understanding non-verbal elements, which included emotional facial expressions[11,35]. These findings supported a literature review study that suggested that individuals with ASD processed facial information slowly. This meant that the fewer and lower-quality facial movements they observed, the more likely they were to interpret the facial expression as neutral[15]. Furthermore, significant statistical results were found when emotional prosody was assessed via the PEPS-C BR (Affect receiving ability test). Children with atypical development were more inclined to assert that a female voice conveyed a positive emotion, even when it did not. Furthermore, they recognized a male voice as having a "negative tone," even when it conveyed a positive emotion. In contrast, the control group displayed a better understanding of the audible emotions in the task. This finding

was consistent with other studies that highlighted the challenge in understanding syntax and emotional prosody among individuals with ASD[7,8,16,17,29].

Understanding emotional contexts can be challenging for individuals with high-functioning autism spectrum disorder (ASD) due to difficulties in communication and imagination, which can lead to an absence of or challenges in processing emotions and ideas[29]. However, certain tests, such as the "TMT-B errors," showed that individuals with ASD performed better than individuals with neurotypical development. This suggested that the TMT-B errors test might not be the best test to assess executive functions in this population, especially as hyperfocus might skew the actual implications. Yet, it also indicated that a *deficit* in cognitive processing might not always be present in ASD, given that there was no statistical difference in other parameters that assessed cognitive function. Furthermore, this improved performance could be attributed to several factors, which included the therapeutic interventions these children undergo and their duration (frequency and years)[10,33,35]. This was indicative that synaptic plasticity translated to clinical improvement as stimulation of these skills was crucial for the child's development[10,18,33].

This study revealed that cognitive aspects were generally consistent across both groups, with the exception of TMT-B errors. Furthermore, the ASD group showed diminished social resourcefulness and a higher prevalence of behavioral problems. Regarding emotion comprehension, children with ASD exhibited challenges in interpreting emotional facial expressions, especially during mixed-emotion situations. They also struggled to understand emotional aspects related to social contexts and had difficulty understanding emotional prosody. These findings suggested that children with ASD required regular assessments and specific stimuli.

This study had limitations concerning its sample size and instruments used. We had a modest sample size, and our findings will need to be replicated in larger samples. While the sample size was chosen for convenience, it only met the minimum requirements for sample pairing. Additionally, the instruments used were not yet standardized for the target population (individuals diagnosed with ASD). Despite these limitations, the significance of this study for the pediatric audience cannot be overstated as limited studies have addressed this topic, particularly within this population. This was due to the inherent characteristics of neurodevelopment and challenges of conducting research with children already diagnosed with ASD without associated intellectual disabilities.

5. CONCLUSION

Based on our findings, we concluded that children with ASD exhibited deficits in social skills and emotion comprehension when compared to a control group of children with neurotypical development of similar age and sex. Future research on this topic, especially with a pediatric population should be done to explore the differences among patients with varying degrees of impairment concerning the emotional facial expressions displayed by both individuals with typical and atypical development. Furthermore, studies should also examine their subsequent comprehension of these expressions as well as their production and comprehension of emotional prosody. We also suggest the development of interventions tailored to enhance these skills among those with ASD. These interventions might employ various strategies, such as replicating/imitating emotional facial expressions and enhancing auditory skills through audible emotional content within a social framework.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author upon the reasonable request. The data are not publicly available due to privacy or ethical restrictions.

Ethical consideration: We further confirm that we have all approved the order of authors listed in the manuscripts. We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, concerning intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property. We further confirm that any aspect of the work covered in this manuscript that has involved human subjects has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript. All participants and their parents or guardians provided written informed consent.

Conflict of Interest: none

Author contributions: CRediT TaxonomyVitoria Santos SantanaConceptualization-Equal, Investigation-Equal, Project administration-Equal, Writing - original draft-EqualJosemar MarchezanConceptualization-Equal, Supervision-Equal, Writing - original draft-EqualDenise Bisolo ScheibeData curation-EqualJoana BückerConceptualization-Equal, Formal analysis-Equal, Supervision-Equal

Handling Editor: Dr. Carmem Gottfried

REFERENCES

1. Kodak T, Bergmann S. Autism Spectrum Disorder. Pediatric Clinics of North America. 2020 Jun;67(3):525–35. https://doi.org/10.1016/j.pcl.2020.02.007.

2. Associação Americana de Psiquiatria – APA. DSM 5 – Manual Diagnóstico e Estatístico de Transtornos Mentais: Transtornos do neurodesenvolvimento: transtorno do espectro autista. Porto Alegre: Artmed; 2014. 50-9. ISBN: 9788582711835.

3. Lai MC, Lombardo MV, Chakrabarti B, Baron-Cohen S. Subgrouping the autism "spectrum": reflections on DSM-5. *PLoS Biol.* 2013;11(4):e1001544. doi:10.1371/journal.pbio.1001544Mecca

4. TP, Orsati FT, Macedo EC. Non-Verbal Cognitive Profile of Young Children with Autism Spectrum Disorders. Psychology. 2014, 1404-1417. http://dx.doi.org/10.4236/psych.2014.511151.

5. Brito AR, Vasconcelos MM de. Autismo: Vivências e Caminhos. São Paulo: Blucher; 2016. Conversando sobre Autismo - Reconhecimento precoce e possibilidades terapêuticas; p. 23-32.

6. Consolini M, Lopes EJ, Lopes RFF. Terapia Cognitivo-comportamental no Espectro Autista de Alto Funcionamento: Revisão Integrativa. Revista Brasileira de Terapias Cognitivas. 2019;15(1). https://doi.org/10.5935/1808-5687.20190007.

7. McCann J, Peppé S. Prosody in autism spectrum disorders: a critical review. International Journal of Language & Communication Disorders. 2003 Jan;38(4):325–50.https://doi.org/10.1080/1368282031000154204.

8. McCann J, Peppé S, Gibbon FE, O'Hare A, Rutherford M. Prosody and its relationship to language in school-aged children with high-functioning autism. International Journal of Language & Communication Disorders. 2007 Jan;42(6):682–702.https://doi.org/10.1080/13682820601170102.

9. Panciera SDP, Buso MS de L, Sargiani R de A, Domingues SF da S, Valério A, Maluf MR. Cognição social e pragmática da linguagem: estudo com crianças autistas. Psico (Internet). 31º de dezembro de 2019 [citado 26º de fevereiro de 2023];50(4):e30603. Disponível em: https://revistaseletronicas.pucrs.br/index.php/revistapsico/article/view/30603.

10. Moura AM, Santos BML dos, Marchesini ALS. O brincar e sua influência no desenvolvimento de crianças com transtorno do espectro autista. Cadernos de Pós-Graduação em Distúrbios do Desenvolvimento [Internet]. 2021 [cited 2023 Feb 2];21(1):24-38. Available from: http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1519-03072021000100003.

11. Conner CM, White SW, Beck KB, Golt J, Smith IC, Mazefsky CA. Improving emotion regulation ability in autism: The Emotional Awareness and Skills Enhancement (EASE) program. Autism. 2018 Nov 7;23(5):1273–87. http://dx.doi.org/10.1177/1362361318810709.

12. Neves M de CL das, Tremeau F, Nicolato R, Lauar H, Romano-Silva MA, Correa H. Facial emotion recognition deficits in relatives of children with autism are not associated with 5HTTLPR. Revista Brasileira de Psiquiatria. 2011 Sep;33(3):261–7. http://dx.doi.org/10.1590/s1516-44462011005000018.

13. Franco M da GS, d'Eça C, Santos NN. Desenvolvimento da Compreensão Emocional. Psicologia: Teoria e Pesquisa (Internet). 2015 Sep;31(3):339–48. http://dx.doi.org/10.1590/0102-37722015032099339348.

14. Drimalla H, Baskow I, Behnia B, Roepke S, Dziobek I. Imitation and recognition of facial emotions in autism: a computer vision approach. Molecular Autism. 2021 Apr 6;12(1).http://dx.doi.org/10.1007/s10802-015-0082-z.

15. Keating CT, Cook JL. Facial Expression Production and Recognition in Autism Spectrum Disorders. Psychiatric Clinics of North America. 2021 Mar;44(1):125–39.http://dx.doi.org/10.1016/j.psc.2020.11.010.

16. Stewart ME, McAdam C, Ota M, Peppé S, Cleland J. Emotional recognition in autism spectrum conditions from voices and faces. Autism (Internet). 2012 Oct 8;17(1):6–14. http://dx.doi.org/10.1177/1362361311424572.

17. Costa-Vieira HA, Souza WC de. O reconhecimento de expressões faciais e prosódia emocional: investigação preliminar em uma amostra brasileira jovem. Estudos de Psicologia (Natal). 2014 Jun;19(2):119–27. https://doi.org/10.1590/S1413-294X2014000200004.

18. Freitas MJ, Lousada M, Alves DC. Linguística clínica: Modelos, avaliação e intervenção. 1st ed. Berlim: Language Science Press; 2022. Capítulo 8, Desenvolvimento da prosódia infantil: Avaliação e intervenção; p. 183-209.

19. Assumpção Jr FB, Bernal MP. Qualidade de vida e autismo de alto funcionamento: percepção da criança, família e educador. Boletim Academia Paulista de Psicolgia (Internet). 2018 (acesso em : 2023 Feb 11);38(94):99-110. Acesso em: http://pepsic.bvsalud.org/pdf/bapp/v38n94/v38n94a10.pdf.

20. Weschsler D. Escala Wechsler Abreviada de Inteligência - WASI: Manual. 1 ed. São Paulo: Casa do Psicólogo; 2014.

21. Cornblatt BA, Risch NJ, Faris G, Friedman D, Erlenmeyer-Kimling L. The continuous performance test, identical pairs version (CPT-IP): I. new findings about sustained attention in normal families. Psychiatry Research. 1988 Nov;26(2):223–38. https://doi.org/10.1016/0165-1781(88)90076-5.

22. Arbuthnott K, Frank J. Trail Making Test, Part B as a Measure of Executive Control: Validation Using a Set-Switching Paradigm. Journal of Clinical and Experimental Neuropsychology. 2000 Aug;22(4):518–28. https://doi.org/10.1076/1380-3395(200008)22:4;1-0;FT518.

23. Weschsler D. Escala Wechsler de inteligência para crianças: Wisc - IV: Manual. 4 ed. São Paulo: Casa do Psicólogo; 2018.

24. Prette Z AP. SSRS - Inventário de Habilidades Sociais, Problemas de Comportamento e Competência Acadêmica para Crianças: Questionário para pais. 1st ed. São Paulo: Pearson Clinical Brasil; 2016.

25. Velloso R, Schwartzman J S. Avaliação de linguagem e de teoria da mente nos Transtornos do Espectro Autismo com a aplicação do Teste Strange Stories traduzido e adaptado para a língua portuguesa (Tese). São Paulo: Universidade Presbiteriana Mackenzie; 2012 (acesso 2021 Oct 23). 114 p.

Disponível: https://dspace.mackenzie.br/handle/10899/2451. Doutorado em Distúrbios do Desenvolvimento.

26. Franco M da G, Roazzi A, Santos NN. O Teste de Compreensão Emocional (TEC): Estudos Psicométricos numa População Portuguesa. Psico-USF. 2020 Jun;25(2):247–60. http://dx.doi.org/10.1590/1413-82712020250204.

27. Souza N, Lima A. Perfil das habilidades prosódicas em crianças e adolescentes com desenvolvimento típico de linguagem: Adaptação transcultural e validação do PEPS-C para crianças e adolescentes (Dissertação). Brasília: Universidade de Brasília; 2020. 82 p. Mestrado em Linguística.

28. Zhang Z, Peng P, Zhang D. Executive Function in High-Functioning Autism Spectrum Disorder: A Meta-analysis of fMRI Studies. Journal of Autism and Developmental Disorders. 2020. https://doi.org/10.1007/s10803-020-04461-z

29. Globerson E, Amir N, Kishon-Rabin L, Golan O. Prosody Recognition in Adults With High-Functioning Autism Spectrum Disorders: From Psychoacoustics to Cognition. Autism Research. 2014 Nov 26;8(2):153–63. https://doi.org/10.1002/aur.1432.

30. Macdonald D, Luk G, Quintin EM. Early Reading Comprehension Intervention for Preschoolers with Autism Spectrum Disorder and Hyperlexia. Journal of Autism and Developmental Disorders. 2022. https://doi.org/10.1007/s10803-021-05057-x.

31. Ashinoff, B. K., Abu-Akel, A. Hyperfocus: the forgotten frontier of attention. Psychological research. 2021 Fev; 85(1), 1–19. https://doi.org/10.1007/s00426-019-01245-8.

32. Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test Revised Version: A Study with Normal Adults, and Adults with Asperger Syndrome or High-functioning Autism. Journal of Child Psychology and Psychiatry. 2001 Feb;42(2):241–51. http://dx.doi.org/10.1111/1469-7610.00715.

33. Marteleto MRF, Chiari BM, Perissinoto J. A INFLUÊNCIA DE HABILIDADES COGNITIVAS NA ADAPTAÇÃO SOCIAL DE CRIANÇAS COM TRANSTORNO DO ESPECTRO AUTISTA. Desenvolvimento da Criança e do Adolescente: Evidências Científicas e Considerações Teóricas-Práticas. 2020 [cited 2022 Jun 7];110–23. http://dx.doi.org/10.37885/200901462.

34. Vogindroukas I, Stankova M, Chelas EN, Proedrou A. Language and Speech Characteristics in Autism. Neuropsychiatric Disease and Treatment. 2022 Oct;Volume 18:2367–77. https://doi.org/10.2147/NDT.S331987.

35. Schaeffer J, Van Witteloostuijn M, Creemers A. Article choice, theory of mind, and memory in children with high-functioning autism and children with specific language impairment. Applied Psycholinguistics. 2017 Nov 6;39(1):89–115.http://doi.org/10.1017/S0142716417000492.