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Empathy and Adaptive Behavior as Predictors of Neurodevelopmental Functioning in Adolescents with Autism Spectrum Disorder

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A B S T R A C T

This study aims to investigate the predictive relationship between empathy, adaptive behavior, and neurodevelopmental functioning in adolescents with Autism Spectrum Disorder (ASD). Understanding how these factors interplay can inform targeted interventions to enhance the quality of life and developmental outcomes for this population. The study employed a cross-sectional design with a sample of 330 adolescents diagnosed with ASD, aged 12 to 18 years. Participants were assessed using the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3) for neurodevelopmental functioning, the Interpersonal Reactivity Index (IRI) for empathy, and the Adaptive Behavior Assessment System, Third Edition (ABAS-3) for adaptive behavior. Data analysis included descriptive statistics, Pearson correlation, and linear regression using SPSS-27. Descriptive statistics revealed mean scores of 85.45 (SD = 15.23) for neurodevelopmental functioning, 52.30 (SD = 8.57) for empathy, and 70.12 (SD = 10.34) for adaptive behavior. Pearson correlation analysis showed significant positive correlations between neurodevelopmental functioning and both empathy ($r = .56$, $p < .001$) and adaptive behavior ($r = .67$, $p < .001$). The regression analysis indicated that empathy ($\beta = .38$, $p < .001$) and adaptive behavior ($\beta = .52$, $p < .001$) significantly predict neurodevelopmental functioning, explaining 55% of the variance ($R^2 = .55$, $p < .001$). The study findings highlight the significant roles of empathy and adaptive behavior in predicting neurodevelopmental functioning in adolescents with ASD. Interventions focusing on enhancing these areas could positively impact the overall development and daily functioning of individuals with ASD. Future research should utilize longitudinal designs to further explore these relationships and examine the effectiveness of targeted interventions.

Keywords: *Autism Spectrum Disorder, Empathy, Adaptive Behavior, Neurodevelopmental Functioning, Adolescents.*

1. Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent deficits in social communication and interaction, along with restricted, repetitive patterns of behavior, interests, or activities (Marotta et al., 2020). The prevalence of ASD has increased significantly over the past few decades, prompting extensive research into its underlying mechanisms, associated behaviors, and effective interventions (Smith et al., 2014). Understanding the factors that influence neurodevelopmental functioning in adolescents with ASD is crucial for developing tailored support strategies that enhance their quality of life.

One key area of interest is the role of empathy and adaptive behavior in predicting neurodevelopmental outcomes in adolescents with ASD. Empathy, defined as the ability to understand and share the feelings of others, is a multidimensional construct that encompasses both cognitive and affective components (Goering & Mrug, 2023). It has been suggested that empathy deficits in individuals with ASD may contribute to their social communication challenges and related behavioral issues (Charman et al., 1997; Vilas et al., 2021). Additionally, adaptive behavior, which includes practical, social, and conceptual skills necessary for daily functioning, is often impaired in individuals with ASD, impacting their ability to navigate various life situations (Tomaszewski et al., 2018).

Empathy development in children and adolescents is influenced by a range of factors, including parental nurturing, disciplinary practices, and the presence of inter-parental conflict (Goering & Mrug, 2023). Research has shown that empathy can moderate the association between parental support and adolescent behavioral outcomes, suggesting that fostering empathy may mitigate aggressive and delinquent behaviors (Graaff et al., 2012). Moreover, empathy deficits are not unique to ASD; they are also observed in individuals with other psychiatric comorbidities, highlighting the importance of executive functions in empathy development (Cristofani et al., 2020).

Adaptive behavior is a critical aspect of neurodevelopmental functioning, as it reflects an individual's ability to effectively cope with environmental demands (Duncan & Bishop, 2013). Studies have demonstrated that adaptive functioning is closely linked to emotional regulation, with difficulties in emotional regulation often leading to impaired adaptive behavior (Davico et al., 2022). Furthermore, discrepancies between cognitive abilities and daily living skills are common in adolescents with ASD, even among those with average intelligence (Duncan & Bishop, 2013).

Empathy is a multifaceted construct involving both cognitive and affective dimensions. Cognitive empathy refers to the ability to understand another person's perspective or mental state, while affective empathy involves sharing and responding to another person's emotional experiences (Rueda & Schonert-Reichl, 2014). Empathy deficits in individuals with ASD have been well-documented, with studies indicating that these individuals often struggle with recognizing and responding to others' emotions (Wallace et al., 2011). These deficits can lead to difficulties in social interactions and relationships, contributing to the broader social communication challenges characteristic of ASD (Johnson et al., 2009).

Adaptive behavior, on the other hand, encompasses a range of skills necessary for independent living and social responsibility. These skills are typically categorized into three domains: conceptual (e.g., communication, functional academics), social (e.g., social interactions, leisure), and practical (e.g., self-care, home living) (Tomaszewski et al., 2018). In individuals with ASD, adaptive behavior often lags behind cognitive abilities, creating a gap that can complicate everyday functioning and the achievement of developmental milestones (Duncan & Bishop, 2013).

The relationship between empathy and adaptive behavior is complex and bidirectional. Empathy can facilitate adaptive behavior by enhancing social understanding and interactions, while deficits in adaptive behavior can impede the development and expression of empathy (Xu, 2023). For instance, individuals with better-developed social skills are more likely to engage in prosocial behaviors, which are often motivated by empathic concern for others (Mesurado et al., 2014). Conversely, difficulties in adaptive functioning, such as poor self-regulation or communication skills, can hinder the ability to perceive and respond appropriately to others' emotions (Feldman et al., 2020).

Given the intertwined nature of empathy and adaptive behavior, it is essential to investigate their combined impact on neurodevelopmental functioning in adolescents with ASD. Previous studies have highlighted the importance of early identification and intervention to address these deficits and promote better outcomes (Picci & Scherf, 2014). For example, interventions aimed at improving emotional regulation and social skills have shown promise in enhancing both empathy and adaptive behavior in this population (Cristofani et al., 2020).

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Music preferences have also been linked to empathy and prosocial behavior, suggesting that certain types of music may foster empathic tendencies and social connectedness (Clark & Giacomantonio, 2013). This association underscores the potential for creative and non-traditional interventions to support the development of empathy and adaptive behavior in individuals with ASD.

Moreover, the family context plays a crucial role in shaping the development of empathy and adaptive behavior. Factors such as parental expectations, support, and disciplinary practices can significantly influence these outcomes (Mesurado et al., 2014; Smith et al., 2014). For instance, parental nurturing has been associated with higher levels of empathy in adolescents, while harsh discipline and inter-parental conflict can have detrimental effects (Goering & Mrug, 2023).

The present study aims to explore the predictive relationship between empathy, adaptive behavior, and neurodevelopmental functioning in adolescents with ASD. By examining these variables, we seek to provide insights that could inform interventions designed to enhance social and adaptive skills in this population. Previous research has established the significance of these factors individually, but there is a need for studies that integrate these variables to understand their combined impact on neurodevelopmental outcomes.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a cross-sectional design to investigate the relationship between neurodevelopmental functioning, empathy, and adaptive behavior in adolescents with autism. The sample size was determined using the Morgan and Krejcie table, ensuring a representative and sufficient number of participants for statistical analysis. A total of 330 adolescents with autism, aged between 12 and 18 years, were recruited from various special education schools and autism support organizations. Inclusion criteria required participants to have a formal diagnosis of Autism Spectrum Disorder (ASD) based on DSM-5 criteria. Exclusion criteria included significant sensory impairments or other neurological conditions that could affect adaptive behavior and empathy assessments. Written informed consent was obtained from the participants' parents or legal guardians.

2.2. Measures

2.2.1. Neurodevelopmental Functioning

To measure Neurodevelopmental Functioning, we used the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3). Developed by Sara Sparrow, David Balla, and Domenic V. Cicchetti in 1984, the Vineland-3 has been widely validated and updated over the years, with its latest edition released in 2016. This tool assesses adaptive behaviors, which are crucial for personal and social sufficiency, across four main domains: Communication, Daily Living Skills, Socialization, and Motor Skills, with an optional Maladaptive Behavior domain. The Vineland-3 consists of 297 items and uses a semi-structured interview format to gather comprehensive information. Scoring is done on a scale that reflects the individual's performance in comparison to age-related norms. The Vineland-3 is known for its high reliability and validity, which have been confirmed in numerous studies, making it a robust measure for assessing neurodevelopmental functioning in various populations, including adolescents with autism (Cristofani et al., 2020; Davico et al., 2022).

2.2.2. Empathy

Empathy was measured using the Interpersonal Reactivity Index (IRI), created by Mark H. Davis in 1980. The IRI is a self-report questionnaire designed to assess multiple dimensions of empathy. It comprises 28 items divided into four subscales: Perspective Taking, Fantasy, Empathic Concern, and Personal Distress. Each subscale consists of seven items, and responses are scored on a 5-point Likert scale ranging from "Does not describe me well" to "Describes me very well." The IRI has demonstrated strong psychometric properties, with extensive research supporting its reliability and validity across different populations. Its multidimensional approach allows for a nuanced understanding of empathy, making it particularly suitable for studying adolescents with autism (Goering & Mrug, 2023; Graaff et al., 2012; Johnson et al., 2009; Overgaauw et al., 2017; Vilas et al., 2021; Wu, 2023; Xu, 2023).

2.2.3. Adaptive Behavior

Adaptive behavior was assessed using the Adaptive Behavior Assessment System, Third Edition (ABAS-3). The ABAS-3, developed by Patti Harrison and Thomas Oakland, was first introduced in 2000, with its latest edition released

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in 2015. This tool evaluates adaptive skills necessary for daily functioning across ten skill areas: Communication, Community Use, Functional Pre-Academics, Home Living, Health and Safety, Leisure, Self-Care, Self-Direction, Social, and Work. The ABAS-3 includes 241 items for children and adolescents, with parents or teachers completing the assessment based on their observations. Scoring provides a General Adaptive Composite (GAC) score, as well as domain-specific scores, allowing for a comprehensive understanding of an individual's adaptive behavior. The ABAS-3 is renowned for its reliability and validity, as substantiated by numerous validation studies, making it a trusted instrument for assessing adaptive behavior in adolescents with autism (Puig, 2013; Tomaszewski et al., 2018).

2.3. Data Analysis

Data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics were calculated for all variables to summarize the demographic and clinical characteristics of the sample. Pearson correlation analysis was conducted to examine the relationships between the dependent variable, neurodevelopmental functioning, and each of the independent variables, empathy and adaptive behavior. This analysis aimed to determine the strength and direction of the associations.

Following the correlation analysis, a linear regression analysis was performed to explore the predictive power of empathy and adaptive behavior on neurodevelopmental functioning. The dependent variable was neurodevelopmental functioning, as measured by the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3). The independent variables were empathy, assessed using the Interpersonal Reactivity Index (IRI), and adaptive behavior, measured by the Adaptive Behavior Assessment System, Third Edition (ABAS-3). The regression model assessed the contribution of each independent variable to the dependent variable while controlling for potential confounding factors.

The significance level for all statistical tests was set at $p < 0.05$. The assumptions of linearity, normality, homoscedasticity, and independence of residuals were checked to validate the regression model.

3. Findings and Results

The sample comprised 330 adolescents with autism, aged between 12 and 18 years. The gender distribution included 204 males (61.82%) and 126 females (38.18%). The participants were predominantly from urban areas (72.12%), with 238 individuals, while 92 participants (27.88%) were from rural areas. In terms of ethnicity, 183 participants (55.45%) identified as Caucasian, 89 (26.97%) as African American, 41 (12.42%) as Hispanic, and 17 (5.15%) as Asian. Additionally, 42 participants (12.73%) were from low-income families, 171 (51.82%) from middle-income families, and 117 (35.45%) from high-income families. Educational placement included 217 participants (65.76%) in special education settings and 113 participants (34.24%) in inclusive education settings.

Table 1

Descriptive statistics for Neurodevelopmental Functioning, Empathy, and Adaptive Behavior

Variable	Mean	Standard Deviation
Neurodevelopmental Functioning (Vineland-3)	85.45	15.23
Empathy (IRI)	52.30	8.57
Adaptive Behavior (ABAS-3)	70.12	10.34

The descriptive statistics indicate in Table 1 that the mean score for Neurodevelopmental Functioning (as measured by the Vineland-3) was 85.45 (SD = 15.23). The mean score for Empathy (assessed using the IRI) was 52.30 (SD = 8.57). The mean score for Adaptive Behavior (measured by the ABAS-3) was 70.12 (SD = 10.34).

The assumptions of linearity, normality, homoscedasticity, and independence of residuals were thoroughly checked and confirmed for the regression analysis. Linearity was assessed through scatterplots of the standardized residuals versus the predicted values, showing a linear relationship between the independent and dependent variables. Normality was evaluated using the Shapiro-Wilk test ($p = 0.156$), indicating that the residuals were normally distributed. Homoscedasticity was confirmed by examining the plot of standardized residuals versus standardized predicted values, which displayed a consistent spread. The Durbin-Watson statistic was 1.981, confirming the independence of residuals. These results validated the

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appropriateness of the linear regression model for the data analysis.

Table 2

Pearson Correlation Coefficients and p-values between Neurodevelopmental Functioning, Empathy, and Adaptive Behavior.

Variables	1	2	3
1. Neurodevelopmental Functioning			
2. Empathy	.56* (.001)		
3. Adaptive Behavior	.67* (.001)	.48* (.001)	

The correlation analysis in Table 2 revealed a significant positive correlation between Neurodevelopmental Functioning and Empathy ($r = .56$, $p < .001$), and between Neurodevelopmental Functioning and Adaptive Behavior ($r = .67$, $p < .001$). Additionally, a significant positive correlation was found between Empathy and Adaptive Behavior ($r = .48$, $p < .001$).

Table 3

Summary of Regression Results

Source	Sum of Squares	Degrees of Freedom (df)	Mean Squares	R	R^2	R^2adj	F	p
Regression	14235.67	2	7117.83	.74	.55	.54	199.78	.001
Residual	11720.45	327	35.86					
Total	25956.12	329						

The regression model in Table 3 showed a significant overall effect, $F(2, 327) = 199.78$, $p < .001$, with an R^2 of .55, indicating that 55% of the variance in Neurodevelopmental Functioning can be explained by Empathy and Adaptive Behavior. The adjusted R^2 was .54, suggesting that the model is a good fit for the data.

Table 4

Results of Multivariate Regression

Predictor Variable	B	Standard Error (SE)	β	t	p
Constant	22.34	5.67		3.94	.001
Empathy	0.75	0.12	.38	6.25	.001
Adaptive Behavior	0.95	0.10	.52	9.50	.001

The multivariate regression analysis in Table 4 revealed that both Empathy and Adaptive Behavior were significant predictors of Neurodevelopmental Functioning. Empathy had a standardized beta coefficient (β) of .38 ($B = 0.75$, $SE = 0.12$, $t = 6.25$, $p < .001$), indicating a moderate positive effect. Adaptive Behavior had a stronger standardized beta coefficient (β) of .52 ($B = 0.95$, $SE = 0.10$, $t = 9.50$, $p < .001$), suggesting a substantial positive impact on Neurodevelopmental Functioning.

4. Discussion and Conclusion

The present study aimed to explore the predictive relationship between empathy, adaptive behavior, and neurodevelopmental functioning in adolescents with Autism Spectrum Disorder (ASD). The findings revealed significant positive correlations between neurodevelopmental functioning and both empathy and adaptive behavior. Furthermore, the regression analysis demonstrated that empathy and adaptive behavior are significant predictors of neurodevelopmental functioning, explaining 55% of the variance.

The significant positive correlation between empathy and neurodevelopmental functioning ($r = .56$, $p < .001$) aligns with previous research highlighting the critical role of empathy in social and cognitive development (Cristofani et al., 2020; Goering & Mrug, 2023). Empathy deficits in individuals with ASD are well-documented and have been associated with difficulties in social communication and interactions (Charman et al., 1997; Wallace et al., 2011).

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This study's findings support the notion that enhancing empathic abilities can contribute positively to neurodevelopmental outcomes in adolescents with ASD.

Similarly, the positive correlation between adaptive behavior and neurodevelopmental functioning ($r = .67$, $p < .001$) underscores the importance of adaptive skills in daily functioning and overall development. Adaptive behavior encompasses a range of practical, social, and conceptual skills essential for independence and social responsibility (Tomaszewski et al., 2018). Previous studies have shown that adaptive behavior is closely linked to emotional regulation and daily living skills, particularly in individuals with ASD (Davico et al., 2022; Duncan & Bishop, 2013). Our findings further reinforce the critical role of adaptive behavior in supporting neurodevelopmental functioning.

The regression analysis indicated that both empathy and adaptive behavior significantly predict neurodevelopmental functioning. Specifically, adaptive behavior had a stronger impact ($\beta = .52$) compared to empathy ($\beta = .38$), suggesting that while both factors are important, adaptive behavior may play a more substantial role in the neurodevelopmental outcomes of adolescents with ASD. This result is consistent with the notion that practical and social skills are crucial for managing daily life challenges and achieving developmental milestones (Puig, 2013; Smith et al., 2014).

These findings are supported by the work of Charman et al. (1997), who demonstrated that empathy is a fundamental component of social interactions and cognitive development in children with ASD (Charman et al., 1997). Similarly, the study by Duncan and Bishop (2013) highlighted the gap between cognitive abilities and daily living skills in adolescents with ASD, emphasizing the need to focus on enhancing adaptive behavior to bridge this gap (Duncan & Bishop, 2013). Moreover, Feldman et al. (2020) and Davico et al. (2022) found that adaptive behavior is closely tied to emotional regulation and daily functioning, further validating our results (Davico et al., 2022; Feldman et al., 2020).

Despite the significant findings, this study has several limitations that should be acknowledged. First, the cross-sectional design limits the ability to draw causal inferences from the data. Longitudinal studies are needed to establish the directionality of the relationships between empathy, adaptive behavior, and neurodevelopmental functioning. Second, the sample was drawn from specific educational and support settings, which may not be representative of all adolescents with ASD. This limits the generalizability of the findings to broader populations. Third, the reliance on self-report measures for empathy and parent-report measures for adaptive behavior may introduce bias. Future research should incorporate multiple informants and observational assessments to obtain a more comprehensive understanding of these constructs.

Future research should address the limitations of the present study by employing longitudinal designs to examine the developmental trajectories of empathy and adaptive behavior in adolescents with ASD. Such studies could provide insights into how these factors evolve over time and their long-term impact on neurodevelopmental outcomes. Additionally, research should explore the effectiveness of interventions aimed at enhancing empathy and adaptive behavior in this population. Randomized controlled trials could test the efficacy of various therapeutic approaches, such as social skills training, emotional regulation programs, and parent-mediated interventions. Furthermore, future studies should consider the role of other potential predictors, such as executive functions, sensory responsiveness, and family dynamics, to provide a more holistic understanding of the factors influencing neurodevelopmental functioning in adolescents with ASD (Cristofani et al., 2020; Feldman et al., 2020; Smith et al., 2014).

The findings of this study have important implications for practice. Interventions targeting empathy and adaptive behavior should be prioritized in educational and therapeutic settings for adolescents with ASD. Programs that enhance empathic abilities, such as social skills training and emotional literacy activities, can help improve social communication and interactions. Additionally, interventions focused on adaptive behavior, including daily living skills training and behavior management strategies, are essential for promoting independence and improving overall functioning. Practitioners should adopt a multidisciplinary approach, involving educators, therapists, and families, to create comprehensive and individualized intervention plans that address the unique needs of each adolescent with ASD. Moreover, training and support for parents and caregivers are crucial, as they play a significant role in fostering the development of empathy and adaptive behavior in their children (Goering & Mrug, 2023; Smith et al., 2014).

In conclusion, this study highlights the significant roles of empathy and adaptive behavior in predicting neurodevelopmental functioning in adolescents with ASD. The findings suggest that interventions targeting these areas can positively impact the overall development and quality of life for this population. Future research should build on these findings by exploring longitudinal trajectories, testing

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intervention efficacy, and examining additional predictors to further our understanding of the complex factors influencing neurodevelopmental outcomes in adolescents with ASD.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

References

Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G., & Drew, A. (1997). Infants With Autism: An Investigation of Empathy, Pretend Play, Joint Attention, and Imitation. *Developmental Psychology*, *33*(5), 781-789. https://doi.org/10.1037/0012-1649.33.5.781

Clark, S. S., & Giacomantonio, S. G. (2013). Music Preferences and Empathy: Toward Predicting Prosocial Behavior. *Psychomusicology Music Mind and Brain*, *23*(3), 177-186. https://doi.org/10.1037/a0034882

Cristofani, C., Sesso, G., Cristofani, P., Fantozzi, P., Inguaggiato, E., Muratori, P., Narzisi, A., Pfanner, C., Pisano, S., Polidori, L., Ruglioni, L., Valente, E., Masi, G., & Milone, A. (2020). The Role of Executive Functions in the Development of Empathy and Its Association With Externalizing Behaviors in Children With Neurodevelopmental Disorders and Other Psychiatric Comorbidities. *Brain Sciences*, *10*(8), 489. https://doi.org/10.3390/brainsci10080489

Davico, C., Marcotulli, D., Cudia, V. F., Arletti, L., Ghiggia, A., Svevi, B., Faraoni, C., Amianto, F., Ricci, F., & Vitiello, B. (2022). Emotional Dysregulation and Adaptive Functioning in Preschoolers With Autism Spectrum Disorder or Other Neurodevelopmental Disorders. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.846146

Duncan, A., & Bishop, S. (2013). Understanding the Gap Between Cognitive Abilities and Daily Living Skills in Adolescents With Autism Spectrum Disorders With Average Intelligence. *Autism*, *19*(1), 64-72. https://doi.org/10.1177/1362361313510068

Feldman, J., Cassidy, M., Liu, Y., Kirby, A. V., Wallace, M. T., & Woynaroski, T. G. (2020). Relations Between Sensory Responsiveness and Features of Autism in Children. *Brain Sciences*, *10*(11), 775. https://doi.org/10.3390/brainsci10110775

Goering, M., & Mrug, S. (2023). The Effects of Parental Nurturance, Harsh Discipline, and Inter-Parental Conflict on Empathy Development in Early Adolescence. *The Journal of Early Adolescence*, *43*(9), 1164-1188. https://doi.org/10.1177/02724316231151997

Graaff, J. V. d., Branje, S., Wied, M. d., & Meeus, W. (2012). The Moderating Role of Empathy in the Association Between Parental Support and Adolescent Aggressive and Delinquent Behavior. *Aggressive Behavior*, *38*(5), 368-377. https://doi.org/10.1002/ab.21435

Johnson, S. A., Filliter, J. H., & Murphy, R. R. (2009). Discrepancies Between Self- And Parent-Perceptions of Autistic Traits and Empathy in High Functioning Children and Adolescents on the Autism Spectrum. *Journal of Autism and Developmental Disorders*, *39*(12), 1706-1714. https://doi.org/10.1007/s10803-009-0809-1

Marotta, R., Risoleo, M. C., Messina, G., Parisi, L., Carotenuto, M., Vetri, L., & Roccella, M. (2020). The Neurochemistry of Autism. *Brain Sciences*, *10*(3).

Mesurado, B., Richaud, M. C., Mestre, M. V., García, P. S., Tur-Porcar, A., Mesa, S. A. M., & Viveros, E. F. (2014). Parental Expectations and Prosocial Behavior of Adolescents From Low-Income Backgrounds. *Journal of Cross-Cultural Psychology*, *45*(9), 1471-1488. https://doi.org/10.1177/0022022114542284

Overgaauw, S., Rieffe, C., Broekhof, E., Crone, E. A., & Güroğlu, B. (2017). Assessing Empathy Across Childhood and Adolescence: Validation of the Empathy Questionnaire for Children and Adolescents (EmQue-CA). *Frontiers in psychology*, *8*. https://doi.org/10.3389/fpsyg.2017.00870

Picci, G., & Scherf, K. S. (2014). A Two-Hit Model of Autism. *Clinical Psychological Science*, *3*(3), 349-371. https://doi.org/10.1177/2167702614540646

Puig, V. (2013). Verbal Memory and IQ Predict Adaptive Behavior in Children and Adolescents With High-Functioning Autism Spectrum Disorders. *Journal of Intellectual Disability - Diagnosis and Treatment*, *1*(1), 22-27. https://doi.org/10.6000/2292-2598.2013.01.01.4

Rueda, P., & Schonert-Reichl, K. A. (2014). Empathic Abilities and Theory of Mind in Adolescents With Asperger Syndrome: Insights From the Twenty-First Century. *Review Journal of Autism and Developmental Disorders*, *1*(4), 327-343. https://doi.org/10.1007/s40489-014-0026-5

Smith, L. E., Greenberg, J. S., & Mailick, M. R. (2014). The Family Context of Autism Spectrum Disorders. *Child and Adolescent Psychiatric Clinics of North America*, *23*(1), 143-155. https://doi.org/10.1016/j.chc.2013.08.006

E-ISSN: 3060-6713

Tomaszewski, B., DaWalt, L. S., & Odom, S. L. (2018). Growth Mixture Models of Adaptive Behavior in Adolescents With Autism Spectrum Disorder. *Autism*, *23*(6), 1472-1484. https://doi.org/10.1177/1362361318815645

Vilas, S. P., Reniers, R., & Ludlow, A. (2021). An Investigation of Behavioural and Self-Reported Cognitive Empathy Deficits in Adolescents With Autism Spectrum Disorders and Adolescents With Behavioural Difficulties. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.717877

Wallace, G. L., Case, L. K., Harms, M. B., Silvers, J. A., Kenworthy, L., & Martin, A. (2011). Diminished Sensitivity to Sad Facial Expressions in High Functioning Autism Spectrum Disorders Is Associated With Symptomatology and Adaptive Functioning. *Journal of Autism and Developmental Disorders*, *41*(11), 1475-1486. https://doi.org/10.1007/s10803-010-1170-0

Wu, Q. (2023). Empathy and Cooperation Vary With Gender in Chinese Junior High School Adolescents. *PsyCh Journal*, *13*(1), 55-65. https://doi.org/10.1002/pchj.705

Xu, Y. (2023). Cognitive Reappraisal and Empathy Chain-Mediate the Association Between Relative Deprivation and Prosocial Behavior in Adolescents. *Frontiers in psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1238308

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