World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Adaptive behavior of school-aged children with Autism Spectrum Disorder

Nikolaos Gerosideris *, Symeon Dimitrios Daskalou, Kolaitis Gerasimos, Georgios Giannakopoulos and Katerina Papanikolaou

Department of Child and Adolescent Psychiatry, School of Medicine, National and Kapodistrian University of Athens, «Aghia Sophia" Children's Hospital, Greece.

World Journal of Advanced Research and Reviews, 2023, 20(03), 731–742

Publication history: Received on 31 October 2023; revised on 09 December 2023; accepted on 11 December 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.20.3.2529

Abstract

Children with Autism Spectrum Disorder (ASD) face challenges related to their functioning, also known as adaptive behavior. Studies in recent literature explore the association between adaptive behavior and cognitive ability in children with ASD.

Aim: The present study investigates adaptive behavior and adaptive skills in children with ASD in relation to their cognitive ability.

Methods: In the present study, the sample consisted of 54 children with ASD, with a minimum Intelligence Quotient-IQ of "70", who were admitted to a Child Psychiatric Hospital Clinic. Screening of functional and cognitive difficulties was performed by administering the Vineland Adaptive Behavior Scales (VABS) and Wechsler's Intelligence Scale for children-III (WISC-III), respectively.

Results: Children with ASD exhibited deviations in adaptive behavior, with a pattern of deficits in adaptive skills ($p<0.001$). The group with high general cognitive score showed higher performance in the areas of Communication and Socialization, compared to the group with low general cognitive score. Both groups showed significant deficits in Daily Living Skills. The relationship between adaptive behavior/adaptive skills was investigated in relation to general, verbal and performance IQ (VIQ-PIQ). The general cognitive score was found to predict the performance of adaptive behavior. In the high cognitive ability group, the verbal and performance cognitive score predicted performance in Communication and Activities of Daily Living, respectively.

Conclusions: The functioning of children with ASD is reflected in adaptive behavior, where a pattern of deficits is presented in relation to the cognitive ability.

Keywords: Function; Adaptive behavior; Adaptive skills; Autism Spectrum Disorder; Intelligence Quotient

1. Introduction

Adaptive behavior represents an individual's ability to functionally cope with the demands of everyday life (Oakland & Daley, 2013) [1]. Historically, adaptive behavior has been an essential criterion in making a diagnosis of intellectual disability (Tassé & Kim, 2023) [2]. With advances in clinical practice and the availability of existing literature, it is found that the assessment of adaptive behavior can describe the individual's functioning, regardless of developmental or psychiatric disorder.

* Corresponding author: Nikolaos Gerosideris.

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder whose core deficits become evident from early childhood, directly affecting the quality of life of the individual (Baio, et al., 2018; Nevison, Blaxill, & Zahorodny, 2018) [3][4]. ASD is characterized by persistent difficulties in social interaction and communication, repetitive patterns and routines, and rigidity in behavior and changes that may occur in daily life (APA,2013) [5]. As a result, these difficulties directly affect an individual's functioning and autonomy in a variety of domains, including development, cognitive functioning, communication, and adaptive behavior (Mouga et al., 2014) [6].

People with ASD represent a group with high heterogeneity in the severity of their deficits. Outcome for individuals on the autism spectrum varies, even for the most cognitively able individuals, where it is influenced by both frequent comorbidity and associated clinical symptoms (Howlin, et al, 2013; Maski, Jeste, & Spence, 2011) [7][8]. In particular, during childhood, children with ASD show a wide variation in overall adaptive functioning as well as performance in the domains of Socialization, Communication, Daily Living Skills (DLS) and Motor Skills (Pugliese et al. 2015) [9]. From the review of the existing literature, a pattern of adaptive functioning emerges, where the findings of the studies describe a specific profile, characterized by deficits of moderate severity in the domain of Communication, high severity in the domain of Socialization and low severity in the domain of Motor and Daily Living Skills (Perry et al., 2009) [10].

Cognitive ability has been presented as a function with a particular interaction with the adaptive skills of the person with ASD. Specifically, a positive correlation is observed, where individuals with lower cognitive level show greater deficits in adaptive skills. Children with ASD without cognitive deficits, however, typically express deficits in adaptive functioning that are of higher severity than would be expected for their cognitive level and age relative to their peers (Farley et al., 2009; Kensworthy et al., 2010) [11][12].

The present study aims to investigate the adaptive functioning of children with ASD and its possible correlation with cognitive ability. Furthermore, it will be investigated whether the general score of intelligence quotient predicts performance on the adaptive behavior total score. Finally, it will be investigated whether the verbal and performance intelligence quotient scores predict performance in the domains of DLS, Communication and Socialization.

2. Materials and methods

2.1. Participants / Sample

The sample consists of 54 children with Autism Spectrum Disorder, 8-12 years of age. Data was collected from the individual files of children, containing measurements and assessments, as they are available in an Autism Clinic of a University Child Psychiatry Department.

2.2. Inclusion criteria

The sample of this study was divided in two groups according to the general intelligence quotient. The sample was obtained from data collected of children files who have received a diagnosis of Autism Spectrum Disorder, assessed with Autism Diagnostic Interview-Revised (ADI-R) (Rutter, LeCouteur, & Lord, 2003) [13] and Autism Diagnostic Observation Schedule-2 (ADOS-2) (Lord, et al., 2018; Lord, et al. 2012) [14][15] diagnostic tools and clinical observation based on DSM - 5 criteria. Each file includes a detailed and comprehensive assessment, with completed reports of the Vineland Adaptive Behavior Scales (VABS) adaptive function assessment tool, as well as the WISC-III cognitive ability measurement tool. There was a strict inclusion restriction to 8-12 years of age, as recent studies on adaptive behavior in children with ASD suggest targeting age groups where there are no large discrepancies in developmental abilities (Bal et al. 2015) [16].

2.3. Exclusion criteria

Participants with manifestations of ASD from congenital neurometabolic conditions or genetic diseases with psychomotor development disorders and children with an overall IQ<70 were excluded from the study. Files of children which did not provide cross-sectional data, as well as incomplete measurements, were not included.

2.4. Procedure

To conduct the present retrospective cohort study, data from the results of the assessment tools previously administered to the children and parents of the sample population by the multidisciplinary team of the Hospital's Child Psychiatry Clinic were used, consisting of a child psychiatrist and an occupational therapist. Only the members of the research team had access to the data and confidentiality of personal data and information was fully respected throughout and after the research, binding the members of the research team. Data from the medical records was

exclusively used for research purposes and no personal information about any individual was published, but the final results of the study. It is stated that no funding was provided to conduct the study.

2.5. Materials

2.5.1. Autism Diagnostic Observation Schedule (ADOS) Second Edition:

The ADOS-2 (Lord, et al. 2012) [15], is a semi-structured and standardized tool that assesses an individual's behavior in the areas of communication, social and reciprocal interaction, imagination/creativity, stereotypic behaviors and restricted interests. It is used in the diagnostic assessment of Autism Spectrum Disorder, for a range of age groups, developmental level and verbal skills. The ADOS is scored using a diagnostic algorithm that provides cut-off values for the diagnosis of ASD (Gotham et al., 2006) [17].

2.5.2. Vineland Adaptive Behavior Scales Adaptive Behavior Scale (VABS)

The VABS is a tool used to assess adaptive functioning and adaptive skills for children and adolescents up to 18 years of age (Sparrow et al, 2005) [18]. It is one of the most widely used tools for measuring adaptive behavior and is based on parental reports of the child's observable behaviors, assessing the level of social, motor, and functional adaptive skills (Sparrow et al., 2005) [18]. It is used for assessment and treatment planning and setting treatment program goals. The tool collects information regarding the individual's daily activities. It categorizes adaptive functioning into four broad domains of adaptive skills and three subdomains. The domains consist of Communication (Expressive, Perceptual, Written), Social (Interpersonal Relationships, Play and Leisure, Self-Management Skills), Activities of Daily Living (Individual-Home-Community), and Motor Skills (Gross and Fine Motor). According to the VABS, motor skills can be assessed up to the age of 6 years. Therefore, they will not be considered in this study as the minimum age of the sample group is 8 years.

2.5.3. Wechsler Intelligence Scale for Children-III (WISC III)

The WISC (Woolger, 2001) [19] is a standardized instrument in Greece (Georgas et al. 1997) [20] that produces indicators representing the overall general intelligence quotient (Intelligence Quotient-IQ), the individual's general cognitive ability, as well as verbal and perceptual ability, processing speed and working memory. In addition, it produces indicators of verbal and performance intelligence. The general intelligence score is derived from the administration of WISC tests, which is designed to measure the general level of cognitive and mental functioning. The set of scores are derived from an individual's performance on a variety of tests that measure acquired knowledge, linguistic reasoning ability, attention to verbal instructions, attention to details, visual spatial processing, and visuomotor coordination. Scores range from IQ >=90 and above for normal and high performance, and from IQ <90 for low and IQ <70 very low performance meeting the criteria for a diagnosis of intellectual disability. Verbal IQ (VIQ) is represented by a score obtained by administering selected subtests of the WISC instrument, which are designed to measure the individual's overall verbal abilities. Similarly, the Performance IQ (PIQ), represents a score that is derived from a subset of tests, which are designed to provide a measure of the individual's visuospatial abilities (Georgas, 2003) [21].

2.6. Statistical analysis

Mean values (mean) and standard deviations (SD) were used to describe the quantitative variables. Numerical values (N) were used to describe the qualitative variables. Independent samples t-test was used to investigate statistically significant difference in the mean values of the ages of the two groups. Pearson's correlation coefficient (r) was used to test the relationship between two quantitative variables. To compare the group with normal IQ (IQ>90) and the group with lower IQ (IQ<90), there was no normal distribution and Mann-Whitney test was used. Repeated measures ANOVA was conducted to investigate the performance of adaptive behavior skills and the differences between them in each group separately. Mauchly's test was used to test for sphericity. The degree of freedom (df) was corrected by the Greenhouse-Geisser method. To further investigate the differences between the VABS domains, a pairwise comparison was performed using the Bonferrroni correction. To investigate the relationship between the General Intelligence Quotient and adaptive function, Spearman's correlation was used. The association between General Intelligence Quotient and adaptive function in children with high IQ scores was further studied using linear regression. The levels of significance are two-sided and statistical significance was set at p=0.05. The statistical program IBM SPSS Statistics was used for the analysis.

3. Results

The sample consisted of 54 children with ASD, divided by cognitive ability into two groups. Children with IQ score higher than "90" formed one group (n_1 = 24) while children with IQ score lower than "90" formed the second group (n_2 = 30). No differences in age (t(52) = .55, p = .58) between the two groups were observed from the analysis.

Table 1 Descriptive characteristics of the sample

Sample	**General Intelligence Quotient**		
		n_1 group 70<=IQ<90	**n_2 group IQ>90**
N	54	24	30
(%)		44.6	55.4
Mean	96.67	79.7	110
Minimum	70	70	90
Maximum	144	89	144
Standard Deviation (St.d)	19.2	6.9	14.4
Age			
Mean	9.333	9.042	8.833
Minimum	8.000	8.000	8.000
Maximum	12.000	12.000	12.000
Standard Deviation (St.d)	1.658	1.429	1.341
Sex			
Boys	35	15	20
(%) Boys	75	62.5	
Girls	19	9	10
(%) Girls	25	20	29.1
VABS	56		
Communication			
Mean	74.036		
Standard Deviation (St.d)	19.474		
Daily Living Skills			
Mean	55.750		
Standard Deviation (St.d)	22.040		
Socialisation			
Mean	73.911		
Standard Deviation (St.d)	17.600		

*IQ= Intelligence Quotient

Repeated measures ANOVA was conducted, between the main VABS domains as within-subject variables to investigate the differences between the domains in each group separately (variables met the normal distribution criterion (Table 2).

Table 2 Statistical distribution control

	Communication		Daily Living		Socialization	
High IQ:	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Mean	64.958	78.333	54.917	52.033	67.292	78.700
Shapiro-Wilk	0.935	0.965	0.946	0.948	0.967	0.971
P-value of Shapiro-Wilk	0.125	0.417	0.224	0.151	0.600	0.554

In the n1 group of children with low IQ score, Mauchly's test of sphericity showed that there was no violation of the sphericity hypothesis (p=.27), so no correction of the degrees of freedom (df) was necessary. The results show that there was a significant difference in the VABS domains (F(2,46) = 6.80, p =.003). To investigate further differences between the VABS domains, pairwise comparisons were performed using the Bonferroni correction for multiple comparisons. The scores on the Daily Living Skills domain were found to be significantly lower than the scores on the Socialization domain (p = .009). There was no significant difference between the Communication and Socialization scores (p = .1) and there was no difference between the Communication and the Daily Living Skills scores (p = .057).

In the n2 group of children with high IQ score, Mauchly's test of sphericity showed that there was no violation of the sphericity hypothesis (p = .66), so no correction for degrees of freedom (df) was necessary. The results show that there was a significant difference in the VABS domains (F(2,58) = 42.24, p < .001). To investigate further differences between VABS domains, pairwise comparisons were performed using Bonferroni's correction for multiple comparisons. Daily Living Skills scores were found to be significantly lower than scores in the Communication domain (p<.001) and the Socialization domain (p<.001). There was no significant difference between the Communication and Socialization scores (p=1).

Furthermore, differences between the 2 groups in each of the VABS domains were examined using independent samples t-test. In the Communication domain, it was observed that children with high IQ score (M = 78.33, SD = 17.83) performed significantly higher than children with low IQ score (M = 65, SD = 14.75; t = 2.95, p = .005). In contrast, in the domain of Daily Living Skills, it was observed that children with high IQ scores (M = 52.03, SD = 17.43) were not significantly different from children with low IQ scores (M = 54.9, SD = 18.43; t = -.59, p = .56). In addition, in the Socialization domain it was observed that children with high IQ scores (M = 78. 7, SD = 19) performed significantly higher than children with low IQ scores (M = 67.2, SD = 14.3; t = 2.43, p = .018). Figure 1 shows the relationships between the 3 domains by each group.

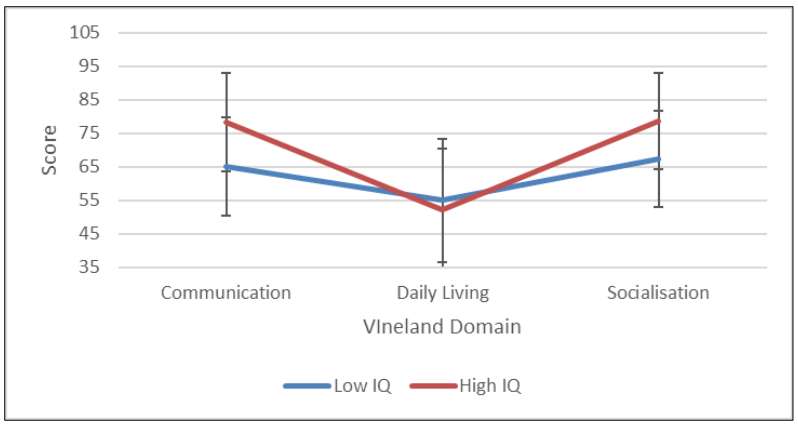


Figure 1 Differences in Vineland Adaptive Behavior domain scores between groups

Mann-Whitney test was used to compare performance between children with normal IQ scores and lower IQ scores because the normal distribution assumption was violated and an independent samples t-test could not be used. The Mann-Whitney test showed that children with high IQ scores had significantly higher adaptive behavior scores (U=253.5, p=.027) (Figure 2).

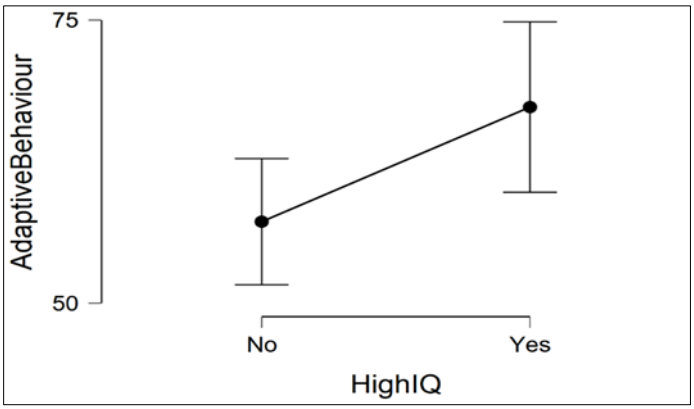


Figure 2 Correlation between adaptive behavior score and intelligence quotient score

Spearman's correlation was used to investigate the relationship between the General Intelligence Quotient and Adaptive Behavior as the General Intelligence Quotient variable did not have a normal distribution (Table 3).

Table 3 Normality check Shapiro-Wilk

	General IQ	
	No	**Yes**
Shapiro-Wilk	0.874	0.896
P-value of Shapiro-Wilk	0.006	0.007

Each group was studied separately. Regarding children with low IQ scores, the general IQ score was found to not be significantly related to adaptive behavior (rs(23)=.003, p=.99). In contrast, in the group of children with high IQ scores, the general cognitive score was found to be significantly related to adaptive behavior (rs(29)=.43, p=.019). Therefore, high IQ scores are correlated with higher scores in adaptive behavior. The correlation between General Intelligence and Adaptive Behavior in the high IQ children group was further studied using linear regression. The variable of general IQ score remained in the model (p < .10), which was found to be statistically significant (F(2,27) = 6.02, p = .021), with R2 = .18. The general cognitive IQ score variable contributed significantly to the model (B = .48, p = .021). The final linear regression model was:

Adaptive Behavior = 12.4 + .48*(General Intelligence Quotient)

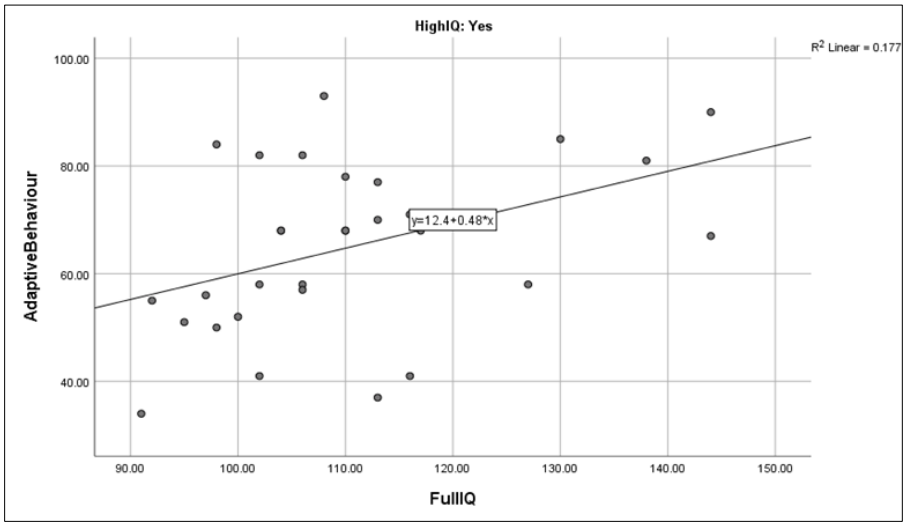
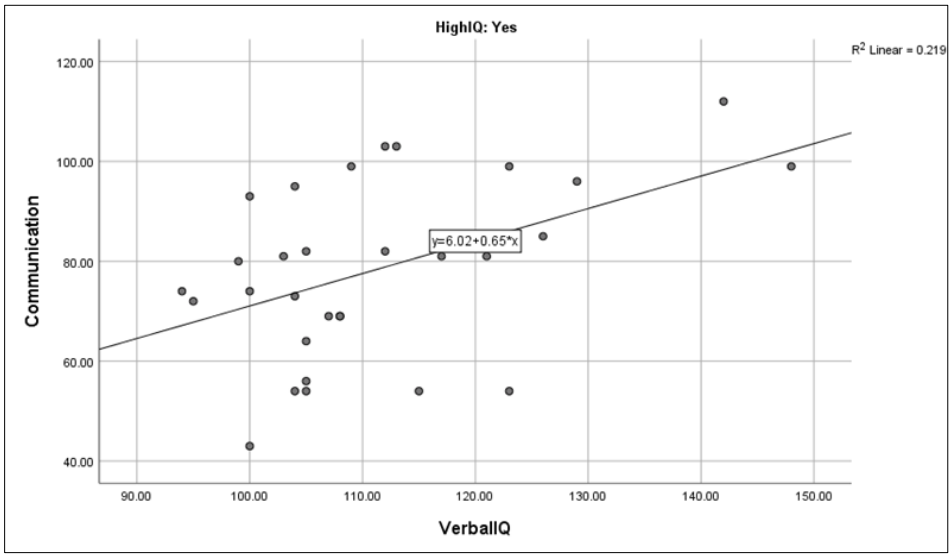


Figure 3 Scatter plot for the values of general intelligence quotient and adaptive behavior scores

The relationship of IQ (verbal/performance) values with each of the VABS domains was then studied for each group separately. To study the relationships between the variables, the multiple regression method was used, using the backward elimination method, with the IQ values as predictors and each of the 3 domains of the VABS as the "Y" (dependent variable). For children with low IQ scores, none of the Verbal & Performance IQ categories remained in the model with Communication ($p > .20$). Therefore, none of the Cognitive IQ categories predicted performance in Communication in children with low IQ score. For children with high IQ scores, the Verbal IQ category remained in the model with Communication ($p < .20$) which was statistically significant ($F(1,28) = 7.84$, $p = .009$), with $R2 = .22$. The Verbal IQ variable contributed significantly to the model ($B = .65$, $p = .009$).

The final linear regression model was:

Communication = 6.02 + .65*(Verbal Intelligence Quotient)



Figures 4 Scatter plot for the Verbal Intelligence Quotient scores and Communication scores

Similarly, for children with a low IQ scores, none of the Verbal & Performance IQ categories remained in the model with Daily Living Skills scores ($p > .20$). Therefore, none of the Cognitive IQ categories predicted performance in the domain of Daily Living Skills in children with low IQ scores. For children with a high IQ scores, the category of Performance IQ scores remained in the model with performance in the Daily Living Skills ($p < .20$) which was statistically significant ($F(1,28) = 5.06$, $p = .029$), with $R2 = .15$. The Verbal Intelligence Quotient variable contributed significantly to the model ($B = .47$, $p = .029$).

The final linear regression model was:

Daily Living Skills = 2.11 + .47***(Performance Intelligence Quotient)**

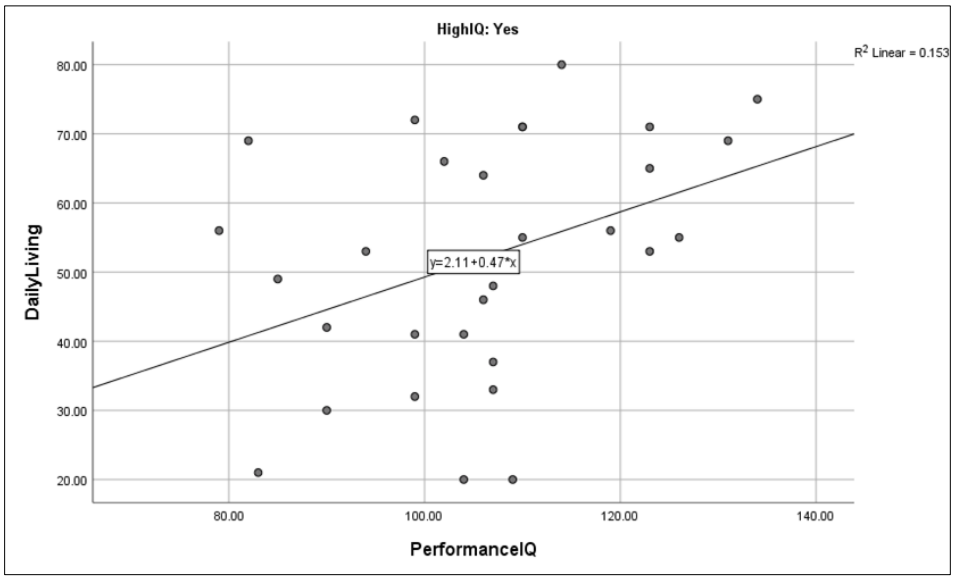


Figure 5 Scatter Plot for Performance Intelligence Quotient scores and Daily Living Scores

For children with low IQ scores, none of the Verbal & Performance IQ categories remained in the model with performance in the Socialization domain ($p > .20$). Therefore, none of the Cognitive IQ categories predicted performance in the Socialization domain in children with a low IQ score.

For children with high IQ, only the Performance IQ category remained in the model with Socialization ($p < .20$) which was statistically significant ($F(1,28) = 3.57$, $p = .069$), with $R2 = .11$; the Verbal IQ variable did not contribute significantly to the model ($B = .44$, $p = 0.069$). Therefore, although the Verbal IQ remained in the model based on the initial restrictions ($p < .20$), its coefficient in the final equation was not statistically significantly different from 0 (having a statistical significance threshold as $\alpha <= .05$). The final linear regression model was:

Socialization = 2.11 + .44***(Performance Intelligence Quotient)**

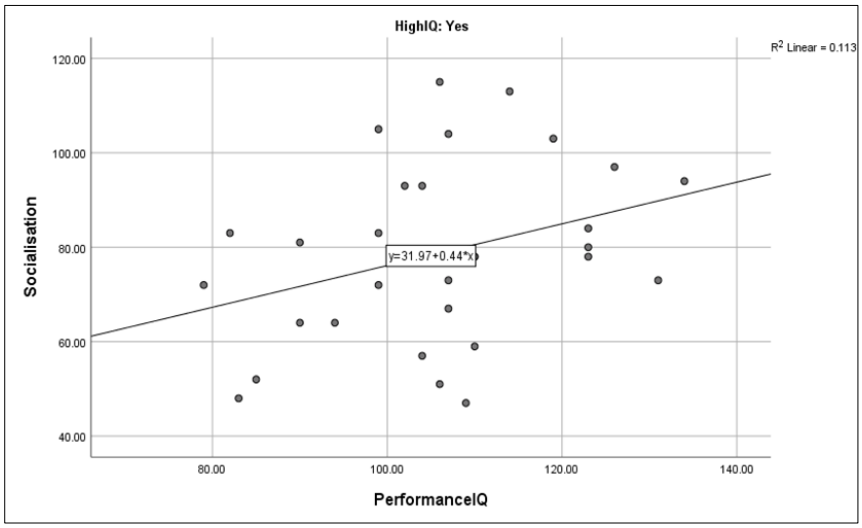


Figure 6 Scatter Plot for the Performance Intelligence Quotient scores and Socialization scores

Only in the group of children with high IQ scores the VABS domains were found to be predicted by at least one of the subcategories of the IQ (Verbal or Performance).

4. Discussion

The analysis of the results shows that children with ASD and low IQ score performed lower on the adaptive behavior total score compared to children with normal IQ score, which is confirmed by similar studies that have focused on investigating adaptive behavior and cognitive indices (Black et al. 2009) [22]. The literature review reports a specific adaptive behavior profile, where children with ASD express greater deficits in the domain of adaptive behavior and cognitive indices (Black et al. 2009) [22]. The domain of Communication and Socialization showed deficits that are verified by the scientific literature (Wetherby et al., 2014; Koegel, et al, 2013) [23][24]. In the present study, the domain of DLS showed the largest deficits compared to the domains of Communication and Socialization in both groups, which has also been found in a recent study by Mouga et al. (2014) [6]. In particular, the group with normal IQ score, presented considerable deficits in the domain of Daily Living Skills, disproportionate to their general IQ score.

In the results of the analysis, general IQ score showed a strong correlation with adaptive behavior, where children with IQ scores >= 90 expressed higher performance in adaptive behavior compared to children with IQ scores < 90. This correlation is also supported by recent scientific literature, where according to Tillmann et al. (2019) [25] and Perry et al. (2009) [10], children with ASD who have normal and above normal general IQ score express higher performance on the VABS adaptive behavior composite score compared to children with ASD and lower general IQ score. However, children with ASD and normal IQ score express deficits in adaptive behavior that are not consistent with their cognitive abilities (Charman et al., 2011; Kanne et al., 2011; Klin et al., 2007) [26][27][28]. In contrast, children with ASD and low cognitive level express deficits in adaptive behavior that are expected from their cognitive ability (Bölte & Poustka, 2002; Perry et al., 2009) [29][10].

Cognitive scores, according to some research, do not show strong predictive value for adaptive behavior in children with ASD and high cognitive scores (Kanne et al. 2011; Farley et al. 2009; Howlin et al. 2013) [27][11][7]. However, as the results of the analysis revealed, general cognitive scores were positively correlated and are able to predict adaptive behavior performance in children with ASD and high IQ score. This finding is confirmed by the research of Perry et al. (2009) [10], where it was found that children's cognitive ability is a predictor of the individual's functioning as reflected through adaptive behavior, even when other intra-individual factors such as age and severity of symptomatology are taken into account.

In the present study, the relationship between the verbal IQ scores and the Communication domain was further investigated, where statistical analysis revealed a positive correlation between them, with the verbal IQ scores being able to predict the performance of children with ASD in the Communication domain. Similarly, the performance IQ scores are able to predict the performance of children with ASD in the VABS Daily Living Skills. According to the literature, higher IQ scores during childhood and adolescence are identified as the most consistent and strongest predictor of better outcomes in adulthood in respect to the Daily Living Skills (Gillespie-Lynch et al., 2012; Gray et al, 2014) [30][31]. In addition, general IQ scores, and in particular verbal IQ scores predict children's performance in the adaptive skill domain of Communication, where children with higher scores showed higher performance in verbal skills (Black et al. 2009 ; Klin et al. 2009) [22][32].

This study presents some limitations, while suggesting new questions for future research directions. Study participants were children, whose adaptive behavior was assessed using the Vineland Adaptive Behavior Scales instrument, where information is obtained from parental reports. This information is used to indirectly assess children's abilities, which may lead to the formation of an incomplete and incomprehensive representation of the individual's functioning. Concurrent information from other settings or caregivers may strengthen the conclusions of subsequent studies. Also, the tool used has not been standardized in the Greek population, and is an older version of the adaptive behavior measure, the VABS-III, which is the most up-to-date, being available since 2016. A further limitation is posed by the design of this study, which does not allow the demonstration of causal association. Future research should include assessments at multiple time points for performance on adaptive behavior and skills, as well as their relationship to cognitive ability, executive function and other factors mentioned. This way, the dynamic interactions of mediating factors relevant to the child and the environment can be better understood.

There is a need for long-term studies focusing on childhood, and additional potential factors that influence children's performance in adaptive skills, such as the severity of ASD symptoms. In those studies, it would be beneficial to explore the exact age range at which the decline in adaptive skills progression begins in order to determine the optimal developmental period for designing and implementing therapeutic interventions (Pugliese et al. 2015) [9]. In addition, subsequent studies may focus on other parameters such as demographic and family factors, level of parental education, potential comorbid psychopathology, and therapeutic intervention.

5. Conclusions

From the literature review and the present study, the belief that deficits in adaptive behavior, and in particular in daily living and social skills, are responsible for the difficulties of the individual in terms of functioning in daily life is supported. An in-depth understanding of these difficulties is critical in identifying appropriate intervention and support that will help to improve the positive life outcome of the person with ASD.

Regardless of the individual factors that may affect the adaptive function of the individual, it is understood that there is a clear need to clarify the relationship between cognitive abilities and adaptive skills. Addressing and supporting these skills before the critical age of adolescence and adulthood is crucial, bearing in mind the autonomy and independent living of the individual.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Oakland, T., & Daley, M. (2013). Adaptive behavior: Its history, concepts, assessment, and applications. *APA Handbook of Testing and Assessment in Psychology, Vol. 3: Testing and Assessment in School Psychology and Education.*, 183–212. https://doi.org/10.1037/14049-009

[2] Tassé, M. J., & Kim, M. (2023). Examining the relationship between adaptive behavior and intelligence. *Behavioral Sciences*, *13*(3), 252. https://doi.org/10.3390/bs13030252

[3] Baio, J., Wiggins, L., Christensen, D.L., Maenner, M.J., Daniels, J., Warren, Z…..

[4] Nevison, C., Blaxill, M. & Zahorodny, W. California Autism Prevalence Trends from 1931 to 2014 and Comparison to National ASD Data from IDEA and ADDM. *J Autism Dev Disord* **48,** 4103–4117 (2018). https://doi.org/10.1007/s10803-018-3670-2

[5] American Psychiatric Association (2013). Diagnostic and statistical manual of mental

[6] Mouga, S., Almeida, J., Café, C., Duque, F., & Oliveira, G. (2014). Adaptive Profiles in Autism and Other Neurodevelopmental Disorders. *Journal of Autism and Developmental Disorders, 45*(4), 1001-1012. doi:10.1007/s10803-014-2256-x

[7] Howlin, P., Moss, P., Savage, S., & Rutter, M. (2013). Social Outcomes in Mid- to Later Adulthood Among Individuals Diagnosed With Autism and Average Nonverbal IQ as Children. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(6). doi:10.1016/j.jaac.2013.02.017

[8] Maski, K.P., Jeste, S.S., & Spence, S.J. (2011). Common neurological co-morbidities in autism spectrum disorders. *Current Opinion in Pediatrics*, 23(6), 609–615.

[9] Pugliese, C. E., Anthony, L., Strang, J. F., Dudley, K., Wallace, G. L., & Kenworthy, L. (2015). Increasing Adaptive Behavior Skill Deficits from Childhood to Adolescence in Autism Spectrum Disorder: Role of Executive Function. *Journal of Autism and Developmental Disorders, 45*(6), 1579-1587. doi:10.1007/s10803-014-2309-1

[10] Perry, A., Flanagan, H. E., Geier, J. D., & Freeman, N. L. (2009). Brief Report: The Vineland Adaptive Behavior Scales Adaptive Behavior Scales in Young Children with Autism Spectrum Disorders at Different Cognitive Levels. *Journal of Autism and Developmental Disorders, 39*(7), 1066-1078. doi:10.1007/s10803-009-0704-9

[11] Farley, M. A., Mcmahon, W. M., Fombonne, E., Jenson, W. R., Miller, J., Gardner, M., . . . Coon, H. (2009). Twenty-year outcome for individuals with autism and average or near-average cognitive abilities. *Autism Research, 2*(2), 109-118. doi:10.1002/aur.69

[12] Kensworthy, L., Case, L., Harms, M. B., Martin, A., & Wallace, G. L. (2010). Adaptive Behavior Ratings Correlate With Symptomatology and IQ Among Individuals With High-Functioning Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 40*(4), 416-423. doi:10.1007/s10803-009-0911-4

[13] Rutter, M. & LeCouteur, A. & Lord, Cesar. (2003). The Autism Diagnostic Interview-Revised. Los Angeles, CA: Western Psychological Services. 24. 659-685.

[14] Lord, Catherine & Elsabbagh, Mayada & Baird, Gillian & Veenstra-VanderWeele, Jeremy. (2018). Autism spectrum disorder. The Lancet. 392. 10.1016/S0140-6736(18)31129-2.

[15] Lord C, Rutter M, DiLavore PC, Risi S, Gotham K, Bishop SL. Autism Diagnostic Observation Schedule. 2nd. Torrance, CA: Western Psychological Services; 2012.

[16] Bal, V. H., Farmer, C., & Thurm, A. (2017). Describing Function in ASD: Using the DSM-5 and Other Methods to Improve Precision. *Journal of Autism and Developmental Disorders, 47*(9), 2938-2941. doi:10.1007/s10803-017-3204-3

[17] Gotham, K., Risi, S., Pickles, A., & Lord, C. (2006). The Autism Diagnostic Observation Schedule (ADOS). *Journal of Autism and Developmental Disorders*.

[18] Sparrow S.S, Cicchetti DV and Balla DA (2005) Vineland Adaptive Behavior Scales Adaptive Behavior Scales. 2nd ed. Circle Pines, MN: American Guidance Service, Inc.

[19] Woolger, C. (2001). Wechsler Intelligence Scale for Children-Third Edition (wisc-iii). *Understanding Psychological Assessment,* 219-233. doi:10.1007/978-1-4615-1185-4_11

[20] Wechsler, D. (1997). To Helleniko WISC-III (J. Georgas, I. N. Paraskevopoulos, E. Besevegis, & N. D. Giannitsas, Trans.). Athens: Psychometric Laboratory, University of Athens. (Original work published in 1991)

[21] Γεωργάς. Δ., Παρασκευόπουλος. Ι., Μπεζεβέγκης, Η., Γιαννίτσας. Ν., Ελληνικό WISC-III Wechsler Κλίμακες Νοημοσύνης για Παιδιά (David Wechsler) – Οδηγός Εξεταστή, Ελληνικά Γράμματα, Πανεπιστήμιο Αθηνών, Αθήνα 1997

[22] Georgas, J.Paraskevopoulos, I.N., Besevegis, E., GIannitsas, N., & Mylonas, K. (2003). Greece. In J.Georgas, L.G.Weiss, E.J.R. Van de Vijver, & D.H. Saklofske (Eds.), Culture and children;s intelligence: Cross-culturaly analysis of the WISC-III (pp. 199-214). San Diego, CA: Academic Press. Doi:10.1016/B978-012280055-9/50015-1

[23] Black, D. O., Wallace, G. L., Sokoloff, J. L., & Kenworthy, L. (2009). Brief Report: IQ Split Predicts Social Symptoms and Communication Abilities in High-Functioning Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 39*(11), 1613-1619. doi:10.1007/s10803-009-0795-3

[24] Wetherby, A. M., Guthrie, W., Woods, J., Schatschneider, C., Holland, R. D., Morgan, L., & Lord, C. (2014). Parent-Implemented Social Intervention for Toddlers with Autism: An RCT. *Pediatrics, 134*(6), 1084-1093. doi:10.1542/peds.2014-0757

[25] Koegel, L. K., Ashbaugh, K., Koegel, R. L., Detar, W. J., & Regester, A. (2013). Increasing Socialization In Adults With Asperger's Syndrome. *Psychology in the Schools, 50*(9), 899-909. doi:10.1002/pits.21715disorders (5th ed.). Arlington, VA.

[26] Tillmann, J., Cáceres, A. S., Chatham, C. H., Crawley, D., Holt, R., Oakley, B., . . . Zwiers, M. P. (2019). Investigating the factors underlying adaptive functioning in autism in the EU-AIMS Longitudinal European Autism Project. *Autism Research, 12*(4), 645-657. doi:10.1002/aur.2081

[27] Charman, T., Jones, C. R., Pickles, A., Simonoff, E., Baird, G., & Happé, F. (2011). Defining the cognitive phenotype of autism. *Brain research*, *1380*, 10–21. https://doi.org/10.1016/j.brainres.2010.10.075

[28] Kanne, S. M., Gerber, A. J., Quirmbach, L. M., Sparrow, S. S., Cicchetti, D. V., & Saulnier, C. A. (2011). The Role of Adaptive Behavior in Autism Spectrum Disorders: Implications for Functional Outcome. *Journal of Autism and Developmental Disorders, 41*(8), 1007-1018. doi:10.1007/s10803-010-1126-4

[29] Klin, A., Danovitch, J. H., Merz, A. B., & Volkmar, F. R. (2007). Circumscribed Interests in Higher Functioning Individuals with Autism Spectrum Disorders: An Exploratory Study. *Research and Practice for Persons with Severe Disabilities, 32*(2), 89-100. doi:10.2511/rpsd.32.2.89

[30] Bölte, S., & Poustka, F. (2002). The Relation Between General Cognitive Level and Adaptive Behavior Domains in Individuals With Autism With and Without Co-Morbid Mental Retardation, *33*(2), 165-172. doi:10.1023/a:1020734325815

[31] Gillespie-Lynch, K., Sepeta, L., Wang, Y., Marshall, S., Gomez, L., Sigman, M., & Hutman, T. (2011). Early Childhood Predictors of the Social Competence of Adults with Autism. *Journal of Autism and Developmental Disorders, 42*(2), 161-174. doi:10.1007/s10803-011-1222-0

[32] Gray, K. M., Keating, C. M., Taffe, J. R., Brereton, A. V., Einfeld, S. L., Reardon, T. C., & Tonge, B. J. (2014). Adult Outcomes in Autism: Community Inclusion and Living Skills. *Journal of Autism and Developmental Disorders, 44*(12), 3006-3015. doi:10.1007/s10803-014-2159-x

[33] Klin, A., Saulnier, C. A., Sparrow, S. S., Cicchetti, D. V., Volkmar, F. R., & Lord, C. (2009). Social and Communication Abilities and Disabilities in Higher Functioning Individuals with Autism Spectrum Disorders: The Vineland Adaptive Behavior Scales and the ADOS. *Journal of Autism and Developmental Disorders, 37*(4), 748-759. doi:10.1007/s10803-006-0229-4