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Original Article

Transdiagnostic Impact of Temperament on Symptom Severity and Quality of Life in Preschoolers with Neurodevelopmental Disorders

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ABSTRACT

Aim: Previous research has indicated that children with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) often display differences in temperament. However, the relationship between temperament and both symptom severity and quality of life in preschoolers remains poorly understood.

Materials and Methods: Temperament was assessed in 27 preschoolers with ADHD and 27 with ASD, and the results were compared with those of 27 typically developing peers. For this purpose, the Children's Behavior Questionnaire-Short Form and the Pediatric Quality of Life Inventory were administered. ASD symptom severity was measured using the Childhood Autism Rating Scale, while ADHD symptom severity was evaluated with the Parent Assessment of Preschool Behavior Scale.

Results: In the ADHD group, symptom severity was positively associated with extraversion and negatively associated with effortful control. Higher levels of negative affectivity and higher extraversion were linked to poorer Pediatric Quality of Life scores. In the ASD group, greater effortful control correlated with both lower symptom severity and higher overall quality of life.

Conclusion: Our findings suggest that temperament traits in preschoolers with ASD and ADHD are associated with both symptom severity and quality of life. Given the limited sample size of this study, longitudinal studies are needed in order to confirm and expand upon these results.

Keywords: Attention deficit disorder with hyperactivity, autism spectrum disorder, child, preschool, neurodevelopmental disorders, quality of life, temperament

Introduction

Autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) are the two most prevalent neurodevelopmental disorders (NDDs) in childhood (1,2). NDDs in early childhood are characterized by heterogeneous clinical manifestations. Although these disorders fall into distinct diagnostic categories, they share a high degree of symptom overlap (3). Although symptom severity is an important prognostic indicator, the heterogeneity of NDDs cannot be fully explained by disorder-specific features (4). Recent evidence suggests that transdiagnostic factors, which vary across individuals independent of categorical

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diagnoses, may hold additional prognostic value beyond baseline symptom severity. Among these, temperament has been identified as an important factor contributing to the heterogeneity of NDDs (5,6).

Temperament is generally conceptualized as a biologically rooted tendency involving the regulation and reactivity of emotional, attentional, and motor processes (7). Despite multiple theoretical perspectives, researchers generally agree that temperament emerges early, is neurobiologically based, remains stable across early childhood, and exhibits consistency across contexts (8). According to Rothbart's widely accepted model, temperament from infancy to late childhood can be described along three major dimensions (9,10). The first dimension, surgency/extraversion, reflects how children respond to potential rewards and is associated with approach behaviors, high activity levels, and positive emotions. The second dimension, negative affectivity, captures the tendency to experience distress and other negative emotions, such as fear, sadness, frustration, and difficulty being soothed. The third dimension, effortful control, represents the child's capacity to regulate attention, manage impulses, and maintain goal-directed behavior. Surgency and negative affectivity (considered as being reactive dimensions) emerge within the first year, whereas effortful control (a regulatory dimension) becomes apparent in the second year as children develop greater conscious awareness (11).

It has been shown that temperament in neurotypical individuals may have both direct and indirect effects on development, including social-emotional, behavioral and psychopathological outcomes across the lifespan (12). Additionally, the idea that temperamental traits may be related to differences in psychopathology has guided several studies. While some studies have focused on predicting clinical symptoms and disorders, others have investigated the link between temperament and psychopathological symptoms (13). Increasing evidence has shown that temperament characteristics not only influence psychosocial adjustment in children with NDDs, but also interfere with interventions and exacerbate functional impairment with subsequent behavioral problems (14).

Examining individual characteristics within the framework of NDDs can enhance the understanding of how symptoms emerge and may also inform the selection of more suitable therapeutic strategies. The present study aimed to examine the relationship between temperament and two contributors to heterogeneity: symptom severity and quality of life.

The hypotheses tested in this study were:

- Hypothesis 1: Children with NDDs display temperamental characteristics which differ from those of their typically developing peers.

- Hypothesis 2: Temperamental traits in children with NDDs are associated with the severity of their symptoms.

- Hypothesis 3: Temperamental differences among children with NDDs are associated with variations in their quality of life.

Materials and Methods

Participants

Three groups were included in this study: preschool-age patients with ASD (n=27) and ADHD (n=27), both diagnosed according to DSM V, and a control group (n=27). All participants were followed at the 2-6 age polyclinic of the department of child and adolescent psychiatry. Their mean age in months was 54.3 months for the ASD group, 58.9 months for the ADHD group and 51.1 months for the control group. There were no significant differences in age or gender across the groups. The diagnoses of the participants were made by two different clinicians, each evaluating the participants independently. Patients with developmental delays, intellectual disabilities, or accompanying neurological-genetic diseases were excluded from this study. Additionally, those who met the criteria for both ASD and ADHD were also excluded. The Childhood Autism Rating Scale (CARS) was applied by the clinician in order to determine the severity of ASD symptoms. The Attention Deficit Hyperactivity Disorder and Disruptive Behavior Disorder Preschool Period Screening and Evaluation Scale was completed by the parents to determine ADHD severity. The Child Behavior Questionnaire-Short Form (CBQ-SF) was completed by the parents to determine temperament characteristics, and the Pediatric Quality of Life Inventory (PedsQL) was completed by parents in order to assess quality of life. A power analysis using G*Power 3.1 (bivariate normal model, 95% confidence, 80% power, H_0 correlation =0.46) indicated that each group required at least 27 participants (15).

Socio-demographic Data Form

The socio-demographic data form was developed by the researchers in order to collect demographic information and was completed by the clinician following parent interviews.

Parent Assessment of Preschool Behavior Scale: PARPS

The PARPS consists of 10 items rated by parents on a four-point Likert scale (0=never to 3=always). Total

scores range from 0 to 30, with higher scores indicating greater behavioral concerns. The scale demonstrates strong internal consistency, with a Cronbach's alpha of 0.92 (16).

The Children's Behavior Questionnaire-short Form (CBQ-SF)

The CBQ-SF, a shortened version of the original CBQ, is a caregiver-report instrument designed to evaluate temperament in children between the ages of 3 and 7 years (17,18). This seven-point Likert-type scale can measure 15 temperament dimensions: activity level, attentional focus, frustration-anger, discomfort, soothability, fear, high-intensity pleasure, low-intensity pleasure, impulsivity, inhibitory control, perceptual sensitivity, sadness, shyness, smiling, and laughter (18).

For analytical purposes, the CBQ-SF is grouped into three overarching temperament dimensions: negative affectivity, extraversion/surgency, and effortful control (18). Extraversion/surgency reflects tendencies toward approach behaviors, positive anticipation, and higher levels of motor and cognitive activity. Negative affectivity refers to the child's propensity to experience negative emotions, while effortful control encompasses the ability to regulate attention, inhibit impulses, and maintain goal-directed behavior. A Turkish adaptation study reported a Cronbach's alpha of 0.78 for the overall scale (19).

Pediatric Quality of Life Inventory (PedsQL)

The PedsQL measures health-related quality of life in children aged 2-18 years. It consists of 23 items, each rated on a 5-point Likert scale ranging from 0 (never) to 4 (almost always). It consists of four domains: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). From these domains, three standardized summary scores can be generated: the Total Quality of Life Score, the Physical Health Summary Score (calculated from the physical functioning items), and the Psychosocial Health Summary Score (derived from emotional, social, and school functioning items) (20).

Psychometric studies have demonstrated good reliability. Psychometric studies report Cronbach's alpha values of 0.88 (child) and 0.90 (parent) for the total score, 0.80 (child) and 0.88 (parent) for physical health, and also 0.83 (child) and 0.86 (parent) for psychosocial health (21).

Childhood Autism Rating Scale (CARS)

CARS is widely used to assess ASD symptom presence and severity in children aged 2 years and above. It is designed to classify symptom severity (ranging from mild to severe ASD) using quantifiable ratings derived from direct clinical observations.

The instrument consists of 15 items which cover a broad range of functional domains, including: interpersonal relations, imitation, emotional response, use of body and objects, adaptability to change and restricted interests, visual and auditory responses, reactions to taste, smell and touch, levels of fear or nervousness, verbal and non-verbal communication, activity level, intellectual response (consistency and quality), and overall impressions. Each item is scored on a 0-4 scale, with higher scores indicating more severe impairment; ratings are based on the frequency, intensity, distinctiveness, and duration of the observed behaviors.

Ethical Considerations

Ethical committee approval for this study was obtained from Ege University Faculty of Medicine Medical Research Ethics Committee (approval number: 22-12.2T/37, date: 29.12.2022).

Statistical Analysis

Statistical analyses were performed using SPSS version 27.0.1. Descriptive statistics are expressed as mean ± standard deviation. Group comparisons were conducted using One-Way analysis of variance for normally distributed variables, followed by post-hoc multiple comparison tests when appropriate. Correlation analyses were performed using Spearman's rank correlation coefficient in order to examine associations between temperament dimensions, symptom severity, and quality of life. A p value of <0.05 was considered statistically significant.

Results

The quality of life of the participants was assessed using the PedsQL by a parent proxy report. Emotional functioning scores were significantly lower in the ADHD group when compared to the control group ($p=0.012$). Social functioning scores were significantly lower in the ASD group compared to the ADHD group and the control group ($p<0.001$). School functioning, psychosocial functioning, and total PedsQL scores were significantly lower in both the ASD and ADHD groups when compared to the control group ($p=0.004$; $p<0.001$; $p=0.001$) (Table I).

The temperament of the children was measured using the CBQ-SF. There was no significant difference between the groups in negative affectivity and effortful control. However, extraversion/surgency scores were significantly higher in the ADHD group compared to the control group (Table II).

Table I. Comparison of PedsQL scores between groups

	Groups			
	Control (n=27)	**ASD (n=27)**	**ADHD (n=27)**	**p value**
PedsQL				
Physical health	88.5±14.6	86.7±12.2	86.1±13.0	0.783
Emotional functioning	79.3±16.3[a]	67.4±19.1[a,b]	65.0±19.2[b]	**0.012**
Social functioning	92.2±14.0[a]	70.0±22.7[b]	81.9±16.1[a]	**<0.001**
School functioning	92.1±8.4[a]	79.5±16.9[b]	80.3±18.4[b]	**0.004**
Psychosocial health	85.8±10.9[a]	70.3±15.6[b]	73.7±14.8[b]	**<0.001**
Total score	87.6±8.6[a]	76.8±11.4[b]	78.9±12.8[b]	**0.001**

Descriptive statistics are expressed as arithmetic mean ± standard deviation
Similar letters in the same row indicate statistical similarities and different letters indicate differences
Bold p-values indicate statistical significance (p<0.05)
PedsQL: Pediatric Quality of Life Inventory, ASD: Autism spectrum disorder, ADHD: Attention-deficit/hyperactivity disorder

Table II. Comparison of CBQ-SF scores between groups

	Groups			
	Control (n=27)	**ASD (n=27)**	**ADHD (n=27)**	**p value**
CBQ-SF				
Activity level	5.19±1.98	5.29±0.82	5.66±0.97	0.407
Anger/frustration	3.81±1.07	4.31±1.23	4.52±1.19	0.079
Approach/positive anticipation	4.95±0.67[a]	5.33±0.91[a,b]	5.77±0.63[b]	**0.001**
Attentional focusing	4.58±0.96[a]	3.42±0.79[b]	3.21±1.20[b]	**<0.001**
Discomfort	3.73±1.13	3.99±1.23	4.41±0.97	0.081
Low intensity pleasure	4.97±0.81	4.27±1.29	4.39±1.17	0.051
Fear	3.99±1.09	4.28±1.48	4.12±1.19	0.719
Soothability	4.68±0.88	5.07±0.95	5.21±0.91	0.095
Impulsivity	4.28±0.85[a]	4.65±0.76[a,b]	5.22±1.15[b]	**0.002**
Inhibitory control	4.99±0.75	4.75±1.23	4.19±1.34	**0.032**
High intensity pleasure	5.27±0.66	5.63±0.82	5.62±0.81	0.157
Perceptual sensitivity	5.60±0.87	5.85±0.91	6.11±0.93	0.135
Sadness	4.47±0.73	4.18±0.96	4.57±0.94	0.238
Shyness	3.42±0.96	3.74±1.45	3.25±1.54	0.398
Smiling and laughter	5.45±0.87	5.10±0.94	5.17±0.89	0.318
Negative affectivity	4.19±0.52	4.20±0.67	4.40±0.49	0.317
Extraversion/surgency	4.50±0.55	4.82±0.47	5.02±0.45	**0.001**
Effortful control	5.18±0.50	4.95±0.61	4.86±0.66	0.127

Descriptive statistics are expressed as arithmetic mean ± standard deviation
Similar letters in the same row indicate statistical similarities and different letters indicate differences
Bold p-values indicate statistical significance (p<0.05)
CBQ-SF: Child Behavior Questionnaire-Short Form, ASD: Autism spectrum disorder, ADHD: Attention-deficit/hyperactivity disorder

Table III. The correlation analysis of CBQ-SF with symptom severity and PedsQL in the ADHD and ASD groups

		CBQ-SF		
		Negative affectivity	**Extraversion/surgency**	**Effortful control**
		r	**r**	**r**
ADHD	**ADHD score**	0.161	0.398*	-0.387*
	PedsQL total	-0.425*	-0.475*	0.095
ASD	**CARS score**	-0.377	0.034	-0.441*
	PedsQL total	0.332	-0.268	0.421*

r: Spearman correlation coefficient
*=p<0.05
CBQ-SF: Child Behavior Questionnaire-Short Form, ASD: Autism spectrum disorder, ADHD: Attention-deficit/hyperactivity disorder, CARS: Childhood Autism Rating Scale, PedsQL: Pediatric Quality of Life Inventory

Correlation analysis indicated that, within the ADHD group, negative affectivity (r=0.425) and extraversion (r=0.475) were inversely related to the total PedsQL score (p<0.05). Conversely, effortful control demonstrated a positive correlation with the total PedsQL score in the ASD group (r=0.421, p<0.05) (Table III).

Discussion

Compared to the growing literature on differences in neurotypical individuals, surprisingly little research has addressed the role of temperament in children with ASD and ADHD. However, in the present study, the temperament dimensions of preschool children with ADHD, ASD, and neurotypical children were evaluated, and the associations of these dimensions with disease severity and quality of life were assessed.

In the current study, those children with ADHD had higher extraversion/surgency levels than neurotypical children; however, no significant group differences were observed in negative affectivity or effortful control. Studies of 175 children with ASD (mean age =10.3 years) and 84 children with ADHD (mean age =10.1 years) reported higher negative affectivity, reduced effortful control, and lower surgency in ASD, whereas children with ADHD showed higher scores for effortful control than those children in the community sample (22,23). In a study directly comparing 27 children with ASD, 27 children with ADHD, and 27 neurotypical children, the clinical groups scored lower than neurotypical children on effortful control. Although effortful control was useful in distinguishing neurotypical children from the clinical groups, it was found to be less effective in distinguishing ADHD from ASD (15). In a systematic review synthesizing the existing evidence on temperament in relation to ASD, it was found that children and adolescents with ASD show distinct temperamental profiles when compared to their typically developing peers and other clinical groups without ASD, marked by elevated negative affectivity, reduced surgency, and diminished effortful control at higher-order levels (4).

Since temperament has been considered an influential factor in problematic behaviour among typically developing children, its association with quality of life and symptom severity in children with NDDs has attracted research interest (24). It has been widely reported that high extraversion is associated with increased externalizing behaviours and fewer internalizing problems, whereas high negative affectivity is associated with an increased risk of internalizing problems (25-28). Effortful control generally reflects the ability to control, regulate, or inhibit behaviors. Throughout development, low levels of effortful control have been reported to be strongly associated with internalizing and externalizing psychopathologies (29,30). In the present study, we observed a positive correlation between ADHD symptom severity and extraversion/surgency and a negative correlation with effortful control. High levels of extraversion/surgency (impulsivity and unsoothability) and low levels of effortful control (poor attentional focus and low inhibitory control) may increase the symptom severity in ADHD. In the present study, negative affectivity and extraversion were negatively correlated with the quality of life in those patients with ADHD. Reduced effortful control (e.g., difficulties in distributing attention, diminished attentional focus, limited attentional shifting, and reduced adaptability) together with elevated negative affect (e.g., greater disorganization, heightened reactivity, increased distress, and lower agreeableness) may negatively influence parent-reported quality of life by impairing functioning in children with ADHD.

In the current study, we found that effortful control was positively associated with the quality of life and negatively

associated with symptom severity in those patients with ASD. This finding is consistent with those of previous studies. Previous research has shown that the developmental course of ASD symptoms may differ depending on variability in temperamental domains, with higher levels of effortful control often associated with fewer symptoms (31). Our results support earlier work linking effortful control with social functioning, empathy, and positive peer perception (32,33). Furthermore, more severe ASD symptoms appear to be related to greater difficulties in behavioral regulation, and lower levels of effortful control may negatively impact overall quality of life.

This study explored temperament-based heterogeneity in ASD and ADHD. Considering temperament characteristics in the assessment of those children with NDDs may help tailor individualized interventions and treatments. Further research is required in this field based on the data obtained in this study.

Study Limitations

This study was the first to examine temperament characteristics and quality of life in preschoolers with ADHD. Its limitations include the small sample size, its cross-sectional design, the single-center nature of this study, and the reliance on parent-report measures for temperament and quality of life.

Conclusion

The present study demonstrates that temperament traits are meaningfully associated with both symptom severity and quality of life in preschool children with ASD and ADHD. In particular, extraversion/surgency and effortful control appear to play a key role in symptom expression and functional outcomes across diagnostic groups. These findings support the importance of a transdiagnostic, temperament-informed perspective in the clinical assessment of NDDs. Considering individual temperament profiles may contribute to more personalized intervention strategies. Future longitudinal studies with larger samples are needed in order to confirm and extend these findings.

Ethics

Ethics Committee Approval: Ethical committee approval for this study was obtained from Ege University Faculty of Medicine Medical Research Ethics Committee (approval number: 22-12.2T/37, date: 02.01.2023).

Informed Consent: Participants and their parents were informed about the study, and written informed consents were obtained.

Footnotes

Authorship Contributions

Concept: S.E., Design: N.B.Ö., Data Collection or Processing: Z.İ.Ş., Analysis or Interpretation: S.E., Z.İ.Ş., Literature Search: S.E., N.B.Ö., Writing: S.E., Z.İ.Ş., N.B.Ö.

Conflict of Interest: All authors declare that they have no conflict of interest.

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