How does anxiety disorder diagnosis affect emotion recognition, empathy and social responsiveness in adolescence?

Burcu Yildirim Budak[1], Funda Gumustas[2], Nese Perdahlı Fis[3]
[1]M.D, Department of Child and Adolescent Psychiatry, Istanbul Medeniyet University, Goztepe Prof. Dr. Suleyman Yalcin City Hospital, Turkey https://orcid.org/0000-0002-2506-0718
[2]Prof., Department of Child and Adolescent Psychiatry, Istanbul Okan University Hospital, Turkey https://orcid.org/0000-0001-8104-9567
[3]Prof., Department of Child and Adolescent Psychiatry, Marmara University Faculty of Medicine, Istanbul, Turkey https://orcid.org/0000-0002-4806-0876

SUMMARY

Objective: We aimed to evaluate the association between the existence of an anxiety disorder (AD) diagnosis in adolescents and social cognition skills such as emotion recognition, empathy and social responsiveness and to compare the results with healthy control group (CG). The second aim of study was to compare the factors affecting social cognition skills in adolescents with ADs with CG.

Method: Psychiatric assessments and diagnoses were evaluated by clinical interview based on DSM-5 and Kiddie-schedule for affective disorders and schizophrenia-present and lifetime version-Turkish Adaptation (K-SADS-PL-T). Wechsler Intelligence Scale for Children-Revised (WISC-R) and Diagnostic Analysis of Nonverbal Accuracy (DANVA) was applied to the participants. Sociodemographic form, Social Responsiveness Scale (SRS), Griffith Empathy Measure (GEM), Strengths and Diffuculties Questionnaire (SDQ), KA-SI Empathic Tendency Scale (KA-SI ETS) were used.

Results: 87 admissions in total were examined for our study. 58 (66.6 %) of the admissions were cases with AD and 29 (33.3%) were the control group. AD group consisted of 34 female adolescents (58.6 %), whereas control group consisted of 17 female adolescents (58.6 %). The average age was 14.06±2.12 (years) and 13.51±2.23 (years), respectively. The adolescents with AD had significantly higher social responsiveness problem scores than the CG after adjusting hyperactivity levels but no difference was found between the two groups in terms of empathy level and emotion recognition.

Discussion: There has been a impairment in social responsiveness in the presence of the AD. It was found that this impairment occurs when anxiety disorder is accompanied by both hyperactivity and low cognitive empathy.

Key Words: Anxiety disorders, face emotion recognition, empathy, social cognition, adolescent.

INTRODUCTION

Anxiety disorders (ADs) are one of the most common problems in child and adolescent psychiatry, and approximately 10% of young people meet the criteria for AD (1). Lack of information processing can increase anxiety by impairing the ability to read interpersonal threat and security signals (2). Emotion recognition, empathy skills and social reciprocity; they are the basic components of human being, who is a social being, in establishing and maintaining social interaction. They are all essential skills for the delivery of social cognition. Although emotion recognition is a social skill that develops earlier in typically developing children, our ability to distinguish between basic facial expressions of emotion shows a slow progression between infancy and early adulthood (3,4). Understanding emotion recognition abilities can be effective in understanding adolescent development and potential mental health issues during this period (4). The inadequacy of these basic early emotion recognition skills has negative consequences for the child's social development and prevents the child from learning about other people's emotions and reactions (3). In literature; it is known that children and adolescents with AD have deficiencies

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in facial emotion recognition skills (2). The amygdala, prefrontal, anterior cingulate, and inferior temporal cortex may play role in deficient face recognition (2).The acquisition of fear-related conections has been associated with the amygdala, the regulation and destruction of these connections depends on the medial prefrontal cortex (5). Among the temporal connections to the prefrontal cortex (PFC), the amygdala is the most prominent and most consistently implicated in anxiety disorders. (6). It has been predicted that children with AD may have a smaller volume of amygdala than healthy children (2). One study reported a significant association between symptom severity of social anxiety and functional connectivity between the amygdala and medial prefrontal cortex, which are involved in the perception of fearful faces (7,8). Facial emotion recognition rates in bipolar disorder (BD), anxiety disorder and healthy control groups were examined in another study. It was found that the facial emotion recognition rates were significantly lower in the AD and especially in BD groups compared to the control group (9).

Empathy is the ability to comprehend and share the emotional state of another person, to provide an appropriate emotional response to the other person's circumstance, or to experience the world through the other person's perspective (10). Empathy has a multidimensional structure. Affective empathy is characterized by feelings of sympathy or a tendency to worry about those experiencing misfortune (11). Cognitive empathy includes recognizing and understanding the emotional state, taking the perspective of others, and mentalization. Therefore, emotion recognition is a critical component of cognitive empathy (12). In the literature, the relationship between anxiety and empathy is an under-researched topic. Empathy-related processes may play a role in the development of anxiety symptoms and related social difficulties. Anxiety and affective empathy were found to be positively related (13). High levels of affective empathy can exacerbate anxiety, particularly in social anxiety disorder (SAD). A lack of cognitive empathy can lead to difficulties in social functioning, failed social relationships, and an increased risk of developing social anxiety (14).

Social reciprocity is one of the important components in providing social interaction. Mutual social behaviors, social use of language, and pathognomonic autistic symptoms are discussed within the context of social interaction. (15). The clinical condition characterized by impaired social reciprocity is autism spectrum disorder (ASD) (16). As a result, earlier research focused on autistic traits in the presence of anxiety condition to investigate the relationship between AD and social reciprocity. SRS is a popular ASD symptom measure. High autistic trait scores in children with AD (17) and phenotypic similarity with ASD (18) have heightened interest in research in this area. In a study conducted in children selected from the normal population with longitudinal design, the bi-directional relationship between autistic and internalizing traits was examined. In the first relationship, autistic traits at the age of 7 contributed to the internalizing traits at the age of 12, and in the second relationship, an asymmetric relationship was found that the internalizing traits at the early age contributed to the autistic features in the late period. The first relationship is greater than the second (19). These results suggest whether autistic traits such as social reciprocity are a possible precursor of AD in later life.

The hypothesis of our study is that emotion recognition, empathy and social reciprocity will be negatively affected in the presence of anxiety disorder. Therefore in this study, we aimed to evaluate the association between the existence of an anxiety disorder diagnosis in adolescents and social cognition skills such as emotion recognition, empathy and social responsiveness and to compare the results with healthy controls.

METHOD

Design and Participants

The study was planned as a cross-sectional clinical study. The study's ethics committee application was approved by the Marmara University Faculty of Medicine Research Ethics Committee on 03.02.2017 under protocol number 09.2017.120. In our study, the anxiety disorder group consisted of 58 adolescents aged 11 to 17 years who were diagnosed with anxiety disorder applied to the child and

adolescent psychiatry outpatient clinic. The control group was formed by adolescents who were referred by the pediatric clinic and had no psychiatric complaints or admissions until then. The diagnosis of anxiety disorder and its exclusion in the control group were provided by two clinicians, a 4-year resident and a specialist physician in the child psychiatry department. A clinical psychiatric interview was conducted with the control group by the same clinicians, and anxiety disorder and its subgroups "diagnostic and statistical manual of mental disorders-5 (DSM-5)" criteria were questioned to rule out the diagnosis of anxiety disorder. The control group consisted of 29 healthy, age- and gender-matched adolescents without any psychiatric diagnosis. In addition, adolescents who described subthreshold anxiety symptoms were not included in the control group. Informed consent was obtained from the all participants and their families.

In the AD group; the exclusion criteria of the study consisted of an intelligence level of less than 70 (Wechsler Intelligence Scale for Children-Revised (WISC-R) verbal, performance and/or total score ≤70), a diagnosis of ASD, psychotic or bipolar disorder and neurological disorder, and a history of substance use or head trauma. In the CG; exclusion criteria of the study consisted of an intelligence level below 70, the presence of a clinical psychiatric disorder according to DSM-5, the presence of chronic and serious medical disease, and neurological disorder.

Clinical Evaluation and Psychometric instruments

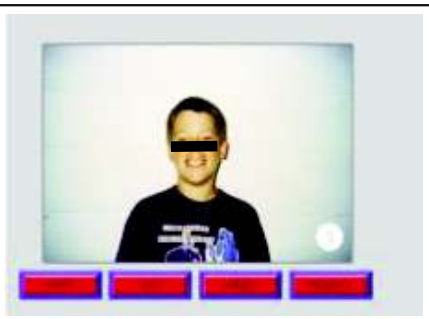
For the general psychiatric evaluation and diagnosis, the participants were administered K-SADS-PL-T. Diagnoses that could not be screened with K-SADS-PL-T were evaluated with the clinician's interview based on DSM-5. WISC-R was applied to evaluate the mental levels of the participants. In the evaluation of adolescents, sociodemographic form, SRS, GEM, SDQ, KA-SI ETS were used. DANVA was applied to the adolescents. The data were first evaluated on two groups, anxiety disorder and control group, and the results were compared between the groups.

Assessments Made by the Clinician:

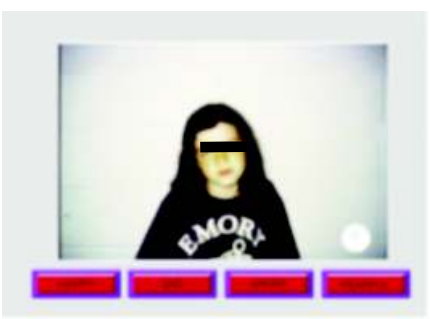
Sociodemographic Form: The sociodemographic characteristics of the adolescents participating in the study were evaluated using a semi-structured sociodemographic information form prepared by the researcher. In the form, information such as the age and gender of the adolescent, the education and socioeconomic level of the family are questioned.

Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL): All the adolescents and their parents who participated in the study were administered K-SADS-PL-T and the psychiatric diagnoses of the adolescents were determined. K-SADS-PL-T was developed by Kauffman et al. to screen for psychopathology in children and adolescents aged 6-18 years, according to DSM-III-R and DSM-IV diagnostic criteria, and is a semi-structured interview form (20). The validity and reliability study in Turkey was conducted by Gökler et al. in 2004 (21).

Diagnostic Analysis of Nonverbal Accuracy (DANVA-2): DANVA is a standardized screening test for the assessment of nonverbal social processing abilities (22). In this study, the Child Facial Expressions (DANVA-CFE) subtest of the test was used. The participant was asked to describe the emotion in each picture. In these subtests, four basic emotions were presented as 'happy, sad, angry and fearful'. In addition, the faces are divided into two different categories as low and high intensity



Figures 1-2



according to the intensity of the emotion expression they contain. Twenty-four children's facial expressions were defined by the children on the computer. In the CFE subtest, each of the four basic emotions was presented six times. Answers can be scored as the sum of correct or incorrect answers. In this study, scores were determined by summing up the number of incorrect answers (Figures 1&2).

Wechsler Intelligence Scale for Children-Revised (WISC-R): WISC, in order to evaluate the mental capacities of children with sufficient speech and language skills, the scale was revised in 1974 and renamed WISC-R, and the age range is 6-16 (23). Validity and reliability studies in our country were carried out by Savaşır and Şahin (24). WISC-R subtests were applied to evaluate the mental capacities of the anxiety and control groups.

Scales filled in by Adolescents

Strength and Difficulties Questionniare (SDQ)-Adolescent Form: Developed by British psychiatrist Robert Goodman in 1997 (25), the SDQ has twenty-five questions questioning positive and negative behavioral characteristics. The questions are grouped under five subtitles; Attention Deficit and Hyperactivity, Behavioral Problems, Emotional Problems, Peer Problems and Social Behaviors. This questionnaire has parent and teacher forms for ages 4-16 and forms filled by the adolescent himself/herself for ages 11-16. Turkish validity and reliability was done by Güvenir et al. (2008) (26).

Child and Adolescent KA-SI Empathic Tendency Scale (KA-SI ETS): It is a measurement tool developed to measure the empathic tendencies of children and adolescents (27). The adolescent form consists of 17 items in total. 10 of them measure affective empathy and 7 of them measure cognitive empathy. As the scores obtained from the scale increase, the empathic tendency increases, and as the scores decrease, the empathic tendency decreases. The Turkish validity and reliability of this scale in children and adolescents was made by Kaya and Siyez (27).

Scales filled in by Parents

Social Responsiveness Scale (SRS): There are 65 items in total in the scale. The items are related to reciprocal social behaviors, social use of language, and pathognomonic autistic behaviors. As the score on the scale increases, the severity of social impairment also increases (15). The Turkish validity and reliability of the scale were evaluated by Ünal et al. (2009) (28).

Griffith Empathy Measure (GEM): The Griffith empathy scale is a comprehensive scale used to measure affective empathy in children. It has three different forms: parental reporting, self-report, and observation of children's affective responses with video recordings. The parental reporting scale was adapted from the Bryant Empathy Scale for Children (29). The validity and reliability of this scale in a Turkish sample was conducted in a thesis study (30).

Statistical Analysis

The data were evaluated using the Statistical Package for the Social Sciences (version 21) program. Descriptive statistics are shown as mean–standard deviation. A 95% confidence interval was used to assess the data. In order to examine whether all continuous variables included in the study were normally distributed, the Kolmogorov Smirnov test was applied and $p>0.05$ was obtained, and it was determined that the variables were normally distributed. Therefore, comparisons were made between the two groups with the T test. The T test was used for comparing SDQ total and subscores in two groups. Pearson correlation analysis was applied for examining correlations of emotional, behavioral symptoms and gender with empathy, facial expression recognition and social reciprocity scores. Hyperactivity levels were measured with the hyperactivity subscale of the SDQ. Gender and hyperactivity level were controlled by using one way analysis of covariance (ANCOVA) in the comparison of empathy, facial expression recognition and social reciprocity scores beween groups. Hierarchical regression analysis was used to define the effects of anxiety disorder status, hyperactivity and cognitive empathy levels on social reciprocity. The alpha expressiveness value was regarded as

Table 1. Comparison of total and subscale scores of strength and difficulties questionnaire between groups

	Anxiety Disorders		Control		
	Mean	SD	Mean	SD	P
Emotional Symptoms	5.30	2.43	3.00	2.46	<0.001**
Conduct Problems	2.09	1.73	1.97	1.30	0.73
Hyperactivity Symptoms	4.58	2.31	4.03	2.11	0.29
Peer problems	2.96	1.74	2.48	1.30	0.19
Total Difficulties	23.18	5.31	19.69	4.96	0.004*
Prosocial Behaviour	8.25	1.64	8.21	2.24	0.92

*p<0.01 **p<0.001

<0.05.

RESULTS

87 admissions in total were examined for our study. 58 (66.6 %) of the 87 admissions were cases with AD, while 29 (33.3 %) were were control group with no psychiatric disorder. There was no missing data. AD group consisted of 34 female adolescents (58.6 %), whereas CG consisted of 17 female adolescents (58.6 %). The average age was 14.06±2.12 (years) and 13.51±2.23 (years), respectively. There was no significant statistical difference between the groups in terms of age (p = 0.265) and gender (p = 1.00). Socioeconomic status was calculated on the basis of parents' education and income levels using the dummy variable (31). When comparing the socioeconomic status between the two groups there was no significant difference (p=0.175), and the mean values were 7.96±2.56 for anxiety disorder group and 7.20±2.14 for control.

There were some psychiatric comorbid diagnoses in adolescents with AD. Attention deficit hyperactivity disorder (ADHD) was the most common comorbid diagnosis with a rate of 34.5 % (n=20). Twenty six percent of anxiety disorder group (n=15) had obsessive compulsive disorder, 24.1 % (n=14) had depression, 6.9 % (n=4) enuresis, 5.2 % (n=3) tic disorder, 3.4 % (n=2) oppositional defiant disorder (ODD), and 1.7 % (n=1) conduct disorder (CD).

We compared the two groups in terms of behavioral and emotional symptoms levels by using SDQ. Emotional symptoms (5,30±2.43; p<.001) and total difficulties (3,00±2.46; p=.004) scores were significantly higher in anxiety disorder group. There were no significant differences in hyperactivity, conduct, peer problems levels and prosocial behavior scores between the two groups (Table 1).

Gender was significantly correlated with emotional symptoms (r=.352; p<.01), parent rated empathy (r=.285; p<.01) and self reported affective empathy (r=.361; p<.01) levels. Emotional (r=.282; p<.01), hyperactivity (r=.349; p<.01) and peer problems (r=.340; p<.01) were positively correlated with social responsiveness problems. Hyperactivity (r=-.335; p<.01), peer (r=-.367; p<.01) and social responsiveness (r=-.374; p<.01) problems were negatively correlated with cognitive empathy. There was significant positive relationship between social responsiveness problems (r=.306; p<.01) and facial expression recognition errors. The correlations of gender, behavioral and emotional symptoms levels, empathy scores, facial expression recognition errors and social responsiveness problem levels are shown in Table 2. As in the study of Ayaz et al., SRS total score was used (32).

Table 2. Correlations of emotional, behavioral symptom scores and empathy levels, facial expression recognition errors and social responsiveness problems

	Emotional	Conduct	HA	Peer	GEM-PR	Affective empathy	Cognitive empathy	DANVA total	SRS
Emotional	1								
Conduct	0.322**	1							
HA	0.305**	0.359**	1						
Peer	0.276*	0.132	0.210	1					
GEM-PR	0.199	-0.192	0.039	0.016	1				
Affective empathy	0.117	-0.127	-0.099	-0.136	0.509**	1			
Cognitive empathy	-0.157	-0.111	-0.335**	-0.367**	0.192	0.602**	1		
DANVA total	0.098	0.044	-0.054	0.139	-0.087	-0.090	-0.115	1	
SRS	0.282**	0.226	0.349**	0.340**	-0.157	-0.184	-0.374**	0.306**	1
Gender	0.352**	-0.050	0.030	0.031	0.285**	0.361**	0.135	-0.087	-0.1

*p<0.05 **p<0.01 ***p<0.001

Note: GEM-PR: Griffith Empathy Measurement- Parent Report; HA: Hyperactivity; DANVA: Diagnostic Analysis of Nonverbal Accuracy; SRS: Social Responsiveness Scale

Coding method of categorical variables in statistical analysis 1:male 2:female

Correlation coefficient values (r) are given in the table. The superscripts in the r value indicate the range in which the p value.

Table 3. Comparison of empathy, facial expression recognition and social responsiveness between groups

	Anxiety Disorders		Control			
	Mean	SD	Mean	SD	F	P
GEM-PR[a]	45,81	10.34	44,97	10.35	0.11	0.73
Cognitive empathy[b]	14,14	4.29	15,79	4.20	2.01	0.16
Affective empathy[a]	19,42	6.28	20,76	7.99	0.88	0.34
DANVA Total	4,88	2.40	4,34	2.32	0.98	0.32
SRS[b]	62,19	23.69	49,76	18.23	4.93	0.029*

*p<0.05

Note: GEM-PR: Griffith Empathy Measurement- Parent Report; DANVA: Diagnostic Analysis of Nonverbal Accuracy; SRS: Social Responsiveness Scale

[a]Adjusted for gender [b]Adjusted for hyperactivity

After controlling for hyperactivity levels, adolescents with anxiety disorders had significantly higher social responsiveness problem scores (62,19±23.69) compared to the control group (49,76±18.23) (p<.05). There were no significant differences between groups in terms of empathy levels and facial expression recognition errors after adjusting for gender and hyperactivity (Table 3).

According to hierarchical regression analysis, hyperactivity symptoms had a positive relationship (B=.24; p<.05) and cognitive empathy had a negative relationship (B=-.25; p<.05) social responsiveness problems. The significant relationship between anxiety disorders status and social responsiveness did not continue when hyperactivity and cognitive empathy added to the regression analysis in step 2 (Table 4).

DISCUSSION

In this study, we first examined the emotional expression recognition, empathy and social responsiveness skills of adolescents aged 11-18 years with a diagnosis of AD. We aimed to compare these parameters with age- and sex-matched healthy adolescents without a diagnosis of AD. We found that there was an impairment in social responsiveness in the AD group compared to CG, but there was no impairment between the two groups in terms of empathy level and emotion recognition Second, we aimed to examine the factors affecting social cognition skills in adolescents with ADs compared to healthy controls. We also looked the relationship of these skills with the symptom levels of emotional and behavioral problems such as hyperactivity and peer problems, and took into account the effect of variables that had a significant relationship between them. We showed that the impairment in social responsiveness in the AD group was accompanied by hyperactivity and low cognitive empathy. The findings are discussed in the light of the relevant literature.

Table 4. Predictors of SRS total

Variable	B	SE (B)	B
Step 1			
Anxiety Disorder Status	12.43	5.02	0.61*
Step 2			
Anxiety Disorder Status	8.85	4.70	0.18
Hyperactivity	2.42	1.03	0.24*
Cognitive Empathy	-1.26	0.54	-0.25*

Predicting Total SRS: ΔR^2=0.068 for Step 1; ΔR^2=0.230 for Step 2.
1:anxiety 0: kontrol *p<0.05

The fact that there was no significant difference between the two groups in the sociodemographic evaluation, which looked at the gender, age, and socioeconomic status of the families, is relevant in terms of group comparison. In both groups, the number of girls is higher than that of boys. In the literature, anxiety in children and adolescents is more prevalent in girls than in boys (33).

Behavioral and emotional problems between the anxiety and control groups were compared with the SDQ. Emotional problems and total difficulty score were found to be significantly higher in the anxiety group. A high score for emotional problems is important in terms of supporting the diagnosis of anxiety disorder in the AD group.

According to the correlation analysis, parent-reported affective empathy and self-reported affective empathy scores were significantly higher in girls than in boys. When we approach the concept of empathy theoretically, social expectations greatly influence gender behavior and roles. This shows that women are arranged to express more empathy than men. This difference between the gender is based on the traditional role of women in child care, parenting instinct, and the development of emotional perceptual skills by mothers to understand their children's feelings and needs in order for their children to survive (34). Research in

infants and young children and animal studies provide evidence that gender differences in empathy also have phylogenetic and ontogenetic roots. Affective empathy motivates prosocial behaviors; This supports the idea that women tend to be more prosocial and altruistic. Evidence from a variety of psychological and behavioral studies supports the idea that key neural networks involved in affective empathy are more developed in women (35). A study examined the relationship between social cognition and gender-specific neural mechanisms, revealing that during tasks performed in an fMRI, women showed greater neural activity in the right inferior frontal cortex and superior temporal sulcus, whereas men exhibited increased activity in the left temporoparietal junction. In face-to-face empathetic interactions, it was found that women utilized mirror neuron-related areas more than men, and that women and men activated different neural mechanisms (36).

A significant negative correlation was found between hyperactivity symptom levels, peer problems and social reciprocity problem levels with cognitive empathy skills in analyse. In our study, ADHD was the most common comorbid condition after the AD diagnosis group. ADHD, which is characterized by symptoms of hyperactivity/impulsivity and/or inattention, includes deficits in cognitive and/or affective empathy as well as impairment in social behavior (37). In a study evaluating both the affective and cognitive components of empathy, it was defined that empathic impairment was higher in the ADHD-combined subtype compared to the ADHD-inattention dominant subtype (38). Inattention and hyperactivity/impulsivity, which are the main features of ADHD, can impair peer interaction due to their nature. Therefore, children with ADHD frequently experience peer problems and rejection (39). There is a positive relationship between hyperactivity and peer problems (40). Considering the mechanisms underlying these social behavior difficulties in hyperactive children, it has been shown that empathy is negatively affected and social perspective-taking levels may be low in children with ADHD (41,42). In a study conducted in adolescents examining empathy and peer bullying, cognitive empathy was found to be associated with physical and relational violence. Cognitive empathy was found to be independent of gender in relational violence; on the other hand, there was a negative correlation in physical violence only in males (43).

The disruption of the interaction between affective empathy and cognitive empathy and the deficit in either of them lead to social impairment (44). Individuals with CD and ASD experience social problems and, as a result, peer problems due to disruptions in empathic processing (45). Potentially overlapping empathy deficits in adolescents with ASD and CD are associated with social behavioral problems in ASD and CD. The ACC/MCC (anterior/middle cingulate cortex) and vmPFC (ventromedial PFC) are part of the default mode network, which has been associated with social cognition and cognitive empathy, which are also disrupted in ASD (46, 47). Structural abnormalities in the vmPFC and ACC/MCC and their relationship to CD features may contribute significantly to ASD symptoms, impair social cognition, and potentially worsen empathy deficits (45).

In our study, after the effects of gender and hyperactivity were controlled, the difference in empathy levels between the AD and CG disappeared. Many studies have shown that internalizing symptoms are positively associated with affective empathy (13). In a study examining the relationship between empathy and anxiety dimensions, affective empathy was positively associated with all anxiety dimensions, with the strongest separation/panic and humiliation/rejection anxiety. Cognitive empathy is negatively related to social and separation/panic anxiety. These results suggested that empathy-related processes may play a role in the development or maintenance of anxiety symptoms. (14). In a study evaluating the level of empathy in individuals with SAD, no clear relationship was found between SAD and empathy levels (48). In another study conducted in individuals with SAD, only a difference in affective empathy was found compared to healthy controls, and it was shown that individuals with SAD were less able to share the positive emotions of others (49). A recent meta-analysis found a significant but weak relationship between anxiety and cognitive empathy. The same meta-analysis also found that the relationships between anxiety and empathy did not differ across types of anxiety (50). It is known that there are

empathy problems in ODD and CD (51). Boys with ODD/CD were impaired in empathy-related responses to negative emotions when accompanied by high levels of anxiety (52). When poor executive attention skills accompany anxiety especially in boys with ODD/CD; found to be associated with less empathy (53).

One of our findings is that social reciprocity problems and the deficiency in facial emotion recognition are positively related to each other. There was no significant difference between the AD group and the CG in terms of emotion recognition. A recent meta-analysis examined social cognitive skills such as emotion recognition and theory of mind in SAD and GAD; impairments in emotion recognition and theory of mind were seen in SAD, but results were equivocal in GAD (8). In the literature, it has been observed that the relationship between social reciprocity and emotion recognition is mostly examined in ASD (54, 55). There are also deficits in emotion recognition in ASD, where social reciprocity is not sufficient (3). In a study conducted with children with low and high functioning autism with a computer-based program, these children were made to practice facial expressions and emotion recognition and eye contact; after these practices, it was noted that there was an improvement in emotion recognition and therefore social skills in both groups (56).

The presence of emotional problems, hence the diagnosis of AD, hyperactivity and peer problems, and impaired social responsiveness were found to be positively related. In studies, SRS is frequently preferred to look at autistic traits in ADHD. As a result of these studies, it is seen that social reciprocity problems are common in ADHD. Social reciprocity problem scores were found to be higher in cases with ADHD-combined type including hyperactivity (57, 58). In studies conducted in our country, it was found that deterioration in social reciprocity was higher in the ADHD group compared to healthy individuals (32, 59). As discussed earlier, impairment in empathy and/or social reciprocity also affects social skills in the ADHD group. And these children may experience peer problems more frequently (40). The impairment in social functioning, which is mostly manifested by peer problems in ADHD, is more severe when ADHD is chronic and/or in the presence of ODD/DD that frequently accompanies ADHD (60). In the evaluation made using SRS in children born preterm, it has been reported that behavioral and emotional problems are high in children with high SRS scores (61). It has been shown that children with less behavioral problems in preschool and school age children have better social skills. In the same study, it was found that girls had better social skills, while boys had more behavioral problems (62).

It was determined that deterioration in social responsiveness continued in the AD group after the effect of hyperactivity level was controlled. In the related literature, it has been seen that social reciprocity is frequently discussed in social anxiety and less frequently in selective mutism from the AD group, similar to the concept of empathy. ASD, social anxiety and selective mutism show phenotypic similarity with impaired social interaction aspect. SRS was used in one study to distinguish between these disorders. And overlapping of SRS scores of the three disorders is shown (63). Preoccupations, avoidance of social situations, repetitive behaviors such as obsessions and compulsions, and speech problems such as dysfluency seen in ADs are also common in children with ASD (18). The "Program for the Education and Enrichment of Relational Skills (PEERS®)" intervention, which is directed at social anxiety symptoms closely related to social skills in individuals with autism, provided significant improvements in social anxiety symptoms and social reciprocity (64). It has been shown that autistic traits during early development and current ASD symptoms are more common in children with AD than typically developing children. The relationship with autistic traits has been shown especially in social phobia (65). In a study examining comorbidity in children with SM, it was reported that 68.5% of children with SM met the criteria for developmental delay and 7.4% met the criteria for Asperger's syndrome (66). In these studies with similar findings to our study, it was observed that the sample size was not very large (18,63,65-66).

One study examined ASD symptoms in children diagnosed with anxiety and/or mood disorders. And more than half of the cases scored above the standard cut-off values on the screening scales

used, including SRS (67). In another study, which was a continuation of the previous research, the relationship between anxiety disorders and ASD symptom scale scores was examined. Adolescents with anxiety or mood disorders were found to exhibit higher SRS scores compared to healthy adolescents. However, no relationship was found between ASD symptom scale scores and subtypes of AD. It had been emphasized that it may be beneficial to include determining social reciprocity problems among the treatment goals in pediatric anxiety disorders and mood disorders (68). In these studies, the subgroup scores of SRS were not examined separately, comments were made on the total score.

In our study, in line with the literature, it was found that social responsiveness problems increased in the presence of the AD. When we examine this situation in detail, in fact, the deterioration in social responsiveness is not due to the presence of the AD alone. Impairment in social responsiveness has been found to occur when AD is accompanied by both hyperactivity and low cognitive empathy. The variables associated with hyperactivity and cognitive empathy levels are discussed in detail.

One of the important limitations of our study is the small sample size. When the sample is divided into groups, the number of cases in the groups and the degree of comparison of the groups with each other decrease. Some of the non-significant findings may be due to the small sample size. The WISC-R used to measure mental capacity in the study is an old intelligence test, and the DANVA used for emotion recognition has not been validated and reliable in the Turkish sample.

Another limitation is the presence of comorbid psychiatric diagnoses in the AD group and the heterogeneity of the group in terms of AD diagnosis. In the presence of a comorbid psychiatric condition, the underlying psychopathology may be on a broader basis only when the mechanisms that will cause the emergence of AD are considered. Considering the multidimensional structure of the AD; it should be noted that etiological factors and symptoms are both similar and divergent. This situation may require separate specific preventive and therapeutic interventions for different ADs.

The issue of AD and empathy is an underresearched topic in the literature. It was observed that empathy studies were mostly performed in the SAD group. The fact that our study deals with this subject is valuable in terms of contributing to the knowledge of the literature. Understanding the relationship between anxiety and emotion recognition, empathy and social responsiveness and the factors affecting this relationship; It will allow a more detailed interpretation of the clinical picture. Improvement of deficits in social cognition will also be taken into account when planning AD treatment. Evidence-based social and relational skills interventions that prioritize peer relationships, CBT, and new computer-based programs, especially in social anxiety, have been added to traditional treatments for anxiety disorders, yielding positive results. Social cognition concepts and anxiety subdimensions can be handled separately in new studies to be conducted in this area. New studies need to be planned to show how social cognition concepts change when anxiety is accompanied by psychiatric conditions such as hyperactivity. Future research in this direction will allow us to obtain new information about the functioning of social-cognitive concepts in the presence of internalizing disorders such as AD.

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Correspondence address: M.D., Burcu Yildirim Budak, Department of Child and Adolescent Psychiatry, Istanbul Medeniyet University, Goztepe Prof. Dr. Suleyman Yalcin City Hospital, Turkey burcuyildirimbudak@hotmail.com

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