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Original Research

Social Cognition in Adolescents with Substance Use Disorder: A Controlled Trial

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ABSTRACT

Objective: Given that Theory of Mind is a fundamental component of social cognition, impairments in this domain may contribute to interpersonal difficulties, impaired social functioning, and poor treatment adherence commonly observed in substance use disorder populations. The number of studies examining social cognitive functioning in children and adolescents with substance use disorder is insufficient in the literature. This study aims to compare the social cognitive functions of adolescents with substance use disorder to those of healthy controls.

Methods: A total of 47 patients aged between 12 and 18 years who were diagnosed with substance use disorder according to Diagnostic and Statistical Manuel of Mental Disorders-5 criteria, and 45 healthy controls were included in the study. Sociodemographic data of the participants were collected, and the Affective Disorders and Schizophrenia for School-Age Children (K-SADS) was administered to assess comorbid psychiatric diagnoses. Theory of mind tests were applied to both groups to assess emotion recognition and mentalizing abilities.

Results: The substance use disorder group had significantly higher rates of living in fragmented families and school dropout, and their fathers' educational level was significantly lower compared to controls. The prevalence of psychiatric diagnoses, particularly current depressive disorders and Attention deficits / Hyperactivity Disorder identified via K-SADS, was significantly higher in the substance use disorder. The social cognition test results showed that performance on theory of mind tests was significantly lower in the substance-using group compared to the control group.

Conclusion: In this study, the findings related to social cognitive impairments, comorbid psychiatric conditions, family structure, and the level of mother/father education with SUD in adolescence may guide assessment, prevention, and intervention efforts in this field.

Keywords: child and adolescent, social cognition, substance use disorder, theory of mind

INTRODUCTION

Substance Use Disorder (SUD) is defined as a chronic condition that leads to functional impairment and affects large populations [1]. The World Health Organization (WHO) defines individuals with substance dependence as "patients who are unable to stop using substances despite the deterioration of their mental and physical health due to prolonged use and who require treatment" [2].

Studies have reported that the global prevalence of cannabis use ranges between 2.8% and 4.5% [3]. Recent research indicates a decrease in the age of initial substance use among adolescents and children under the age of 18 [4]. The prevalence of cannabis use among students in 8th and 12th grades was found to be 20.4% and 48.8%, respectively; for inhalants, 17.1% and 13.0%; and for opioid derivatives, 1.7% and 1.8% [5]. Another study conducted in the United States found the prevalence of substance use among university students to be 42.4% [6]. A nationwide survey conducted in Türkiye during the 2015–2016 academic year among 1,997 11th-grade students revealed that 35% had tried smoking at least once, and 20.1% reported smoking on an almost daily basis. As for alcohol consumption, 18.7% had used alcohol at least once in their lives, while 1.8% indicated near-daily use. Elevated rates of cigarette and alcohol use were significantly more common among certain subgroups, including students enrolled in vocational high schools, males, those in the 12th grade, individuals who rated their academic performance as low, had received disciplinary penalties, experienced school absenteeism, had encounters with law enforcement, reported having peers who used tobacco, alcohol, or other substances, or had a history of psychological treatment[7]. The concept of social cognition fundamentally encompasses the awareness of minds other than one's own, the ability to understand and engage with complex nonverbal communication skills in social environments, the capacity to make inferences about others' behaviors, and the recognition of their beliefs [8].

Main Points

- Adolescents with substance use disorders exhibit poorer emotion recognition skills compared to those in the control group.
- Theory of mind abilities are more impaired in adolescents with substance use disorders.
- Adolescents with substance use disorders are more likely to come from broken families and present with additional psychiatric diagnoses.
- The presence of comorbid psychiatric disorders may further impair emotion recognition and theory of mind abilities, highlighting the need for comprehensive assessments in treatment planning.
- Early onset of substance use in adolescents may be associated with deficits in social cognitive functioning, potentially exacerbating interpersonal and academic difficulties.

Although theory of mind (ToM) and mentalization skills share conceptual similarities, they are distinct constructs. ToM is primarily concerned with recognizing and inferring situational events, such as understanding others' beliefs, intentions, and perspectives. In contrast, mentalization emphasizes an ongoing awareness of internal and external experiences, particularly in relation to emotions and sensory perceptions, and involves reflecting on both one's own and others' mental states in affectively charged contexts [9].

Social cognition, or social cognitive functioning, is distinct from neurocognition. It plays a role in linking all social processes with neurocognitive mechanisms. Five distinct parameters have been proposed for the assessment of social cognition: social perception, emotion recognition, attributional bias, social knowledge, and theory of mind [10]. SUD, deficits in theory of mind, particularly in the context of impaired social functioning, may contribute to reduced functional capacity and present challenges in treatment [11]. A meta-analysis conducted in 2015 demonstrated that individuals who use alcohol and substances show impairments in facial emotion recognition and exhibit theory of mind deficits [12].

Unlike verbal communication skills, nonverbal abilities persist continuously in social settings and constitute a central and automatic process that can be crucial not only for communication but also for academic success in children [13]. The appropriate expression of emotions and their accurate interpretation by others are essential components of interpersonal communication skills and, consequently, play a significant role in the context of social relationships [14]. Several studies have suggested that the inability to recognize emotions from facial expressions accurately may lead to impairments in social functioning [15]. Research exploring the link between substance use and social

cognitive processes has predominantly focused on adults. It has been found that individuals with alcohol dependence exhibit reduced emotion recognition capacity both in cases of chronic long-term use and in medium-term consumption [16]. Impairments in the ability to recognize emotions have been observed not only with chronic long-term use but also following acute, high-dose alcohol intake [17]. Another study on opioid users revealed that, as the duration of opioid maintenance treatment increased, patients' ability to recognize angry facial expressions declined. At the same time, they tended to recognize happy faces more readily [18].

A longitudinal study on cannabis use in adolescents demonstrated that theory of mind is affected within the adolescent population [19]. As current literature on substance use and emotion recognition among children and adolescents is relatively sparse, additional studies are warranted to deepen understanding in this area. This study aims to evaluate the theory of mind, emotion recognition, and perspective-taking abilities of adolescents with substance use disorder. The primary objective of the study is to assess the social cognitive functions of adolescents with substance use disorder in comparison with healthy controls and to identify potential factors influencing social cognition.

MATERIALS AND METHODS

Participants

This study was conducted with two groups: a patient group consisting of adolescents aged 12 to 18 diagnosed with Substance Use Disorder (SUD) — including alcohol, cannabis, hallucinogens, inhalants, opioids, sedatives/hypnotics/anxiolytics, and stimulants (amphetamines/cocaine) — who were receiving either inpatient or outpatient treatment at Dokuz Eylül University Provincial Directorate of Health Child and Adolescent Alcohol and Substance Addiction Treatment Center (CAASAT) between 22.12.2019-24.03.2020; and a control group composed of voluntary adolescents aged 12 to 18, who were evaluated by child psychiatry and pediatrics clinic in an university hospital, had no current or past diagnosis of SUD. During the study period, participants who presented to the outpatient clinic or were hospitalized in the inpatient unit and consented to take part were included in the study. Both groups matched in terms of age and gender.

Exclusion criteria are: Having a severe intellectual or physical impairment that may affect test performance, the presence of a comorbid neurological or cognitive disorder, a comorbid psychiatric diagnosis that significantly impairs functioning (CGAS scores below 50 and more), and substance use within the past week and the presence of any severe impairment that may interfere with the adolescent's performance on theory of mind tests (e.g., autism spectrum disorder), or being in an acute phase of illnesses that impair reality testing (e.g., schizophrenia, disruptive behavior disorder, acute manic episode, severe depression/anxiety).

To determine the size of the study population required in both the patient and control groups, a power analysis was conducted based on previous research involving adolescents with and without SUD (such as the thesis study by Kıyak et al. [20], 2018, conducted with 88 volunteers across three groups with sample sizes of 30, 30, and 28, respectively). The analysis, using an alpha value of 0.05, a beta value (power) of 0.20, and a 95% confidence interval, indicated that a minimum of 32 participants per group would be necessary to detect a significant difference of two points between the groups. Forty-seven participants who had SUD and 45 controls were involved in the study. Ethical approval for this study was obtained from the Non-Invasive Research Ethics Committee of Dokuz Eylül University (Date: 03.04.2019, Approval No: 2019/08-15). Institutional permission was also granted. Prior to participation, all individuals were informed about the purpose of the study. All participants provided informed consent through both written documentation and verbal confirmation.

Scales and Data Collection

Sociodemographic data form: This is a form developed by the researchers to evaluate the psychological, developmental, sociodemographic, and familial characteristics of all adolescents in the study group.

Kiddie and Young Adult Schedule for Affective Disorders and Schizophrenia Present and Lifetime Version (K-SADS-PL): The scale was developed by Kauffman et al. in 1997 [21]. The K-SADS-PL is a semi-structured interview that screens for 22 psychopathologies in children and adolescents, assessing both current and lifetime diagnoses according to DSM-IV diagnostic criteria[22]. This interview was performed in order to clarify the major or current diagnosis of participants.

Faces Test: The Faces Test was developed by Ekman in 1972 to assess emotion recognition from facial expressions. A total of six expressions are presented: angry, sad, neutral, happy,

disgusted, and fearful. Participants are asked to review 60 photographs reflecting emotional expressions and select the one that corresponds to the facial expression shown [23]. In this study, the long form of the test was used. The lowest score on the Faces Test is 0, and the highest is 60.

Reading Mind In The Eyes Test (RMET): The RMET was developed by Baron-Cohen et al. [24] in 1997 for adults and was revised in 2001 to create a child version. The test aims to assess the ability of participants to understand mental states that go beyond basic emotions by observing eye expressions. The child version consists of 28 black-and-white photographs showing only the eye region, with four multiple-choice options for each photo. One point is awarded for each correct response, and the highest score is 28. A score of 9 or higher is considered to indicate that the responses are not due to chance.

Faux Pas: Baron-Cohen et al. [25] (1999) developed the Faux Pas Test tasks to assess higher-level mental attributions, in addition to other social cognition tests. The Faux Pas Test is considered a reliable measure of the severity of second-order theory of mind deficits. It is a scale composed of ten scenarios, designed to assess the ability to understand faux pas. Each scenario includes five questions. The first two questions assess the ability to understand/identify the gaffe, while the third question evaluates the understanding of the "inappropriate situation" causing the faux pas. The fourth question assesses the ability to predict another person's mental state, termed "false belief," and the fifth question evaluates the ability to predict the emotional state of the person hearing the faux pas, termed "empathy" [25]. Each story includes two control questions to check whether the participant has understood the scenario correctly.

Hospital Anxiety and Depression Scale (HADS): The scale was developed by Zigmond and Snaith [26]. The scale is a self-assessment tool used for screening, not for diagnostic purposes. Completing the scale takes approximately 2 to 5 minutes. The 14-item HADS consists of two subscales: the Anxiety subscale (HADS-A) and the Depression subscale (HADS-D), each containing seven mixed items [27]. For each item, participants select a response from four options, and scores are assigned on a scale of 0-3 points.

Statistical Analysis

The normality of continuous variables was assessed using skewness and kurtosis values, normality tests, and histograms. In descriptive statistics, categorical variables were presented as frequency (n) and percentage (%), while continuous variables were expressed as mean ± standard deviation (minimum–maximum). The independent samples t-test was used for data with a normal distribution, while the Mann-Whitney U test was applied when the data did not meet the assumption of normality. Categorical variables were analyzed using Pearson's chi-square test, and Fisher's exact chi-square test was applied when necessary. The Mann-Whitney U test was used in cases when the sample size of the group being analyzed was 30 or fewer. The research data were analyzed using the SPSS 24 statistical software package. Results were deemed statistically significant when the p-value was less than 0.05.

RESULTS

The study group consisted of 47 adolescent patients aged 12 to 18 years with Substance Use Disorder (SUD) and 45 adolescents without SUD. Statistical analysis revealed no significant variation between the SUD and control groups concerning age, gender, birth weight, or the ages at which participants began walking and speaking. The duration of breastfeeding was found to be significantly lower in the SUD group than in the control group ($p=0.047$). The proportion of individuals not attending school was significantly greater in the SUD group (83%) compared to the control group (0%) ($p < 0.001$). In the substance-using group, both family income level and mother's and father's education level were significantly lower (Family income= $p=0.002$, mother's education= $p<0.001$, father's education= $p<0.001$). The sociodemographic and developmental characteristics of the study group are detailed in Table 1. All participants in the SUD group were smokers, whereas 37.8% of the control group reported smoking. A significant difference was identified between the two groups ($\chi^2 = 42.039$, $p < 0.001$). Additionally, while 84.4% of the control group lived with both parents, this rate was 34.0% in the SUD group ($x^2=24.089$, $p<0.001$). Furthermore, none of the participants in the control group were under institutional care, whereas 11 participants (23.4%) in the SUD group were residing in social service institutions.

Post hoc power analysis indicated that the study sample was sufficient to achieve adequate statistical power (beta value =0.20, alpha value= 0.05, continuous endpoint, two independent sample size requested is=70).

Given that family income level and maternal education were identified as potential confounders, subgroup analyses were

Table 1. Sociodemographic and Developmental Characteristics of the Groups

Sociodemographic variables	SUD	Control Group	t/ x^2/p
Age	(n=47)	(n=45)	t= -1.975
Mean ±SD	16.57 ± 0.61	16.11 ± 1.48	df= 90 *p=0.51
Birth Weight	(n= 40)	(n= 41)	t= 0.669
Mean ± SD	2856.25 ± 642.72	2936.1 ± 407.8	df= 79 *p= 0.505
Breastfeeding(Month)[1]	(n= 43)	(n= 40)	t= 2.022
Mean ± SD	9.83 ± 12.02	14.25 ± 7.02	df= 81 ***p= 0.047**
Walking(Month)	(n=39)	(n= 42)	t= -0.988
Mean ± SD	13.41 ± 4.84	12.54 ± 2.82	df= 79 *p= 0.326
Talking(Month)	(n= 38)	(n= 42)	t= 0.572
Mean ± SD	22.39 ± 5.32	22.98 ± 3.69	df= 78 *p= 0.569
Toilet Training(year)	(n= 36)	(n= 42)	t= -2.102
Mean ± SD	3.44 ± 2.86	2.5 ± 0.52	df= 76 ***p= 0.039**
Gender			x^2= 0.001
Male	27 (57.4%)	26 (49.1%)	df= 1
Female	20 (42.6%)	19 (48.7%)	**p= 1.000
Attend School			x^2= 64.817
Yes	8 (17.0%)	45 (100.0%)	df= 1
No	39 (83.0%)	0 (0.0%)	****p< 0.001**
Income level	21 (48.8%)		x^2=9.601
Low-Mild	22 (51.2%)	8 (17.8%)	df= 1
Moderate-High		37 (82.2%)	****p= 0.002**
Mother's Education			x^2=18.641
Elementary school	39 (84.8%)	18 (40.9%)	df= 1
High school or higher	7 (15.2%)	26 (59.1%)	****p< 0.001**
Father's Education			x^2=21.102
Elementary school	36 (83.7%)	16 (35.6%)	df= 1
High school or higher	7 (16.3%)	29 (64.4%)	****p< 0.001**

*: Independent sample t test; **: Chi Square test; SUD: Substance Use Disorder; SD: Standart Deviation

performed. These analyses demonstrated that the robust and statistically significant differences observed in RMET total scores, Faux Pas scores, and Faces Test scores persisted ($p < 0.001$).

The substance use durations, age of onset, frequency of use, duration of abstinence, and quantity of use for the group with substance use disorder are presented in Table 2.

It was found that adolescents with SUD had significantly higher scores on the HADS-Anxiety subscale compared to the control group (p=0.001), and their scores on the HADS-Depression subscale were also significantly higher than those of the control group ($p <0.001$). The results are presented in Table 3.

When adolescents with and without SUD were compared in terms of psychiatric diagnoses, the presence of any psychiatric

diagnosis, either past or current, was found in 85.1% (n=40) of those with SUD and 28.9% (n=13) of those in the control group. This difference was statistically significant (Chi-square test **p<0.001**). The results are presented in Table 4.

The mean score on the Faces Test among adolescents with SUD (47.34 ± 6.47) was significantly lower compared to the control group (51.53±3.75) (Independent samples t-test, p<0.001). Similarly, the Eyes Test score of adolescents with SUD (17.91 ± 4.53) was significantly lower than that of the control group (21.8±4) (Independent samples t-test, p=0.016). The total score on the Faux Pas Test for the SUD group (31.70 ± 15.34) was also significantly lower than that of the control group (41.67 ± 8.99) (Independent samples t-test, p<0.001). Furthermore, all subscale scores of the Faux Pas Test (Faux Pas Detection, False Belief, Empathy, and Understanding Inappropriateness) were significantly lower in the SUD group compared to the control group. Comparison of social cognitive functions between individuals with SUD and the control group is shown in Table 5.

Subgroup Analysis

The number of patients using stimulants was higher within the substance use disorder group. Therefore, to determine whether there was an internal difference within the substance use group, it was divided into two subgroups (stimulant/other), and a subgroup analysis was conducted. The subgroup analysis revealed no significant differences between the groups (Table 6).

Table 2. Characteristics of SUD Group

Alcohol and other Substances	**n (%)**	**Duration of Use (year)**	**Age Onset of Using Substance**	**Frequency of Use (day/week)**
		Mean ± SD	**Mean ± SD**	**Mean ± SD**
Alcohol	2 (2.6%)	4.0 ± 1.41	13 ± 1.41	3.5 ± 0.71
Opioid	6 (7.8%)	2.66 ± 0.82	14.0 ± 1.1	6.5 ± 1.22
THC	10 (13.0%)	2.8 ± 1.69	14.0 ± 1.49	4.70 ± 2.45
Hypnotic	2 (2.6%)	3.0 ± 0.0	14.0 ± 0.0	5.00 ± 2.83
Synthetic	3 (3.9%)	2.5 ± 1.32	13.3 ± 1.52	7.0 ± 0.0
Other/Multiple	3 (3.9%)	3.3 ± 0.58	13.66 ± 0.58	4.33 ± 2.31
Amphetamine	17 (22.1%)	2.38 ± 1.56	14.05 ± 1.75	4.82 ± 2.17
Other stimulants	4 (5.2%)	1.62 ± 0.48	15.00 ± 1.15	6.0 ± 4.0
	n (%)	**Amount of Substance Used**	**Duration of Wash Out (day)**	**Smoking Use (box/year)**
Alcohol	2 (2.6%)	10.0 ± 2.83 (std drk)	7.0 ± 0.0	**Mean ± SD**
Opioid	6 (7.8%)	3.66 ± 3.2 (gr)	25.8 ± 19.67	2.25 ± 1.06
THC	10 (13.0%)	1.75 ± 1.03 (gr)	31.40 ± 29.24	3.83 ± 2.5
Hypnotic	2 (2.6%)	7.00 ± 4.24 (pill)	7.0 ± 0.0	3.9 ± 2.04
Synthetic	3 (3.9%)	4.33 ± 2.89 (gr)	12.67 ± 2.31	3.75 ± 1.06
Other/Multiple	3 (3.9%)	-	28.00 ± 27.78	3.66 ± 0.58
Amphetamine	17 (22.1%)	3.32 ± 2.98	23.00 ± 14.34	3.75 ± 2.16
Other stimulants	4 (5.2%)	9.75 ± 6.18 (pill)	11.75 ± 3.3	5.2 ± 3.15

SD: Standart Deviation, std drk: Standart Drink

Table 3. Comparison of Hospital Anxiety Depression Scale Scores with Substance Use Disorder (SUD) and Control Group

HAD Scale Subdomains	SUD (n=47) (Mean ± SD)	Control Group (n=45) (Mean ± SD)	t*	p	Cohen's d
HADS Anxiety	10.93 ± 5.19	7.82 ± 3.58	**-3.339**	**0.001**	**-0.696**
HADS Depression	9.59 ± 5.17	6.29 ± 2.87	**-3.769**	**<0.001**	**-0.786**

*: Independent Sample t-test; SD: Standard Deviation; HADS: Hospital Anxiety and Depression Scale

Table 4. Psychiatric Diagnoses of Adolescents Identified Through K-SADS Assessment

K-SADS Diagnosis	SUD Group (n=47) n (%)	Control Group (n=45) n (%)	p
PAST DIAGNOSES			
No diagnosis	13 (36.2)	32 (71.1)	**<0.001***
Any diagnosis **	34 (72.3)	13 (28.9)	
Depressive Disorder	11 (23.4)	2 (4.4)	**0.021***
Anxiety Disorder	2 (4.3)	2 (4.4)	1.000†
Bipolar Disorder	1 (2.1)	0 (0.0)	1.000†
Conduct Disorder	6 (12.8)	0 (0.0)	**0.026**†
ADHD	11 (23.4)	7 (15.6)	0.343*
ODD	1 (2.1)	2 (4.4)	0.613†
Enuresis	2 (4.3)	0 (0.0)	0.495†
CURRENT DIAGNOSES			
No diagnosis	14 (29.8)	40 (88.9)	**<0,001***
Any diagnosis **	33 (70.2)	5 (11.1)	
Depressive Disorder	7 (14.9)	0 (0.0)	**0,012**†
Bipolar Disorder	2 (4.3)	0 (0.0)	0,495†
Conduct Disorder	3 (6.4)	0 (0.0)	0,242†

† Fisher's exact test, * Chi-square test, ** Some participants had more than one diagnosis.

Table 5. Comparison of Social Cognitive Functions Between Individuals with Substance Use Disorder (SUD) and Control Group

Emotion Recognition and Theory of Mind Scales	SUD (n=47) (Mean ± SD)	Control Group (n=45) (Mean ± SD)	t*	p	Cohen's d
Faces Test Scores	47.34 ± 6.47	51.53 ± 3.75	**3.780**	**<0.001**	**0.788**
RMET Scores	17.91 ± 4.53	21.8 ± 4	**4.316**	**<0.001**	**0.9**
	(n=44)	(n=45)			
Faux Pas Total Scores	31.70 ± 15.34	43.4 ± 8.1	**4.514**	**<0.001**	**0.957**
Faux Pas Detection	13.61 ± 6.13	17.61 ± 3.9	**3.889**	**<0.001**	**0.825**
False Belief	5.80 ± 3.31	8.4 ± 1.8	**4.624**	**<0.001**	**0.980**
Empathy	6.00 ± 3.15	8.78 ± 2.15	**4.862**	**<0.001**	**1.031**
Understanding Inappropriateness	6.30 ± 3.17	8.40 ± 1.80	**4.624**	**<0.001**	**0.980**

* Independent Sample t-test; SD: Standard Deviation; RMET: Reading Mind in The Eyes Test

Table 6. Comparison Of Social Cognitive Functions Between Stimulant Users And Other Users

Emotion Recognition and Theory of Mind Scales	Stimulant Mean + SS (n=21)	Other Substances Mean + SS (n=26)	U	p
Faces Test Scores	49.24 ± 6.24	45.73 ± 6.44	188.000	0.066
RMET Scores	17.57 ± 4.20	18.19 ± 4.84	247.000	0.591
	(n=20)	**(n=24)**		
Faux Pas Total Scores	36.45 ± 13.75	27.75 ± 15.75	167.000	0.085

U: Mann-Whitney U test; SD: Standard Deviation; RMET: Reading Mind in The Eyes Test

DISCUSSION

In our study, 47 adolescents with substance use disorder and 45 controls were compared in terms of sociodemographic, clinical, and developmental characteristics. Statistically significant differences were found in maternal education level, family income level, school attendance, duration of breastfeeding, psychiatric comorbidities, anxiety, and depressive symptoms. It was found in a previous study that parental education levels were significantly lower in the SUD group than in the control group [28]. Similarly, a different study examining family characteristics also reported that maternal education levels were lower in the group with substance use [29]. A meta-analysis conducted on studies about adolescents with substance use disorder (SUD) found that low socioeconomic status increased the risk of SUD by 22% [30]. A large-scale study conducted in Korea also reported that the families of adolescents with substance use disorder (SUD) had a lower socioeconomic status compared to those in the non-SUD group [29]. The same study demonstrated that adolescents with substance use disorder (SUD) had significantly shorter durations of education compared to their non-SUD peers. In our study, the duration of breastfeeding was found to be shorter, and toilet training occurred later in the substance use disorder (SUD) group compared to the control group. These findings may indicate a potential link between early caregiving processes and the development of substance use disorders.

In our study, hospital depression and anxiety scale (HADS) scores were compared, and as expected, higher scores were found in the SUD group. A cut-off value of 8 or higher has been recommended for both subscales [31]. The present study examined the prevalence and characteristics of psychiatric comorbidities in individuals with SUD, in comparison to a demographically matched control group with no history of substance use. The results indicated that the SUD group exhibited significantly higher rates of comorbid psychiatric conditions, including ADHD, anxiety disorders, mood disorders, and disruptive behavior problems. These results are in line with previous literature demonstrating that SUD rarely occurs in isolation and is frequently embedded within a broader spectrum of psychopathology [32]. One plausible explanation for these elevated comorbidity rates lies in the shared vulnerability hypothesis, which suggests that genetic, neurobiological, and environmental risk factors may predispose individuals to both substance misuse and other psychiatric disorders. For instance, deficits in emotion regulation, impulse control, and executive functioning have been implicated in both SUD and disorders such as depression, bipolar disorder, and ADHD [33]. It should be noted that the higher depression and anxiety scores and increased comorbidity rates may have influenced the ToM and recognition of emotion test results.

The facial emotion recognition test revealed a statistically significant distinction between individuals with substance use and those in the control group. In the literature, a study conducted on adult individuals with methamphetamine use disorder reported that the scores of the methamphetamine use disorder group on the Facial Emotion Recognition Test were significantly lower compared to a control group [34]. A meta-analysis reported that adult patients with alcohol use disorder scored significantly lower on emotion recognition tests, with particularly notable impairments in recognizing angry and disgusted facial expressions [11].

In our study, in addition to the facial emotion recognition test, the ability to read the mind in the eyes was also found to be significantly impaired in the substance use group compared to the control group. McDonald et al. [35] 2013 reported that high-dose heroin use had a greater impact on cognitive performance in cognitive function tests. However, no significant connection was

found between the patients' different clinical characteristics and cognitive function. It was suggested that this impairment might be more closely related to the direct toxic effects of the substance. However, the literature remains controversial regarding whether the amount of substance used or the type of substance directly affects cognitive function test scores or has a significant impact on the Eye test scores. Another study showed that opioid users have a strong deficit in both aspects of theory of mind skills (faux pas and RMET) [36].

Similar to earlier research, our results indicate that chronic substance use may negatively affect neural circuits involved in mentalizing, such as the medial prefrontal cortex, temporoparietal junction, and amygdala [37]. Notably, in our study, ToM deficits observed in the SUD group were particularly pronounced in tasks requiring second-order reasoning and affective perspective-taking, suggesting a disruption in both cognitive and emotional components of ToM.

One potential explanation for the above-mentioned findings lies in the neurotoxic effects of prolonged substance use on brain areas crucial for social cognition. Alternatively, impaired ToM abilities may precede and contribute to the development of SUD by increasing interpersonal difficulties, reducing empathy, and impairing social judgment, which may in turn exacerbate social isolation and increase reliance on maladaptive coping mechanisms such as substance use [38].

McDonald et al. [35] (2013) reported that adults with SUD exhibited impairments in "false belief" understanding, which refers to the ability to comprehend another person's intentions and thoughts, as well as in "empathy," the ability to understand and feel another person's emotions. In another study assessing alcohol dependence in adults in terms of "false belief" ability, participants were shown videos. It was found that the majority of individuals with alcohol use disorder performed significantly worse than the control group in terms of understanding what others were thinking [39].

As mentioned above, studies were conducted to determine whether these deficits are associated with the type of substance used; the stimulant-using group was compared with the group using other substances; however, no significant differences were found. Although the result was not statistically significant, the value being close to the threshold suggests that the difference might reach significance in studies with larger sample sizes.

The fact that these impairments are similarly observed in both adulthood and adolescence, as seen in our study, and that the impairments occur independently of the type of substance used, suggests that the problem may not be substance-related impairment. Instead, it raises the possibility that social cognitive deficits may predispose individuals to substance use.

Limitations

Some important limitations were identified in the course of this study. It is a cross-sectional case-control study conducted within a clinical sample. To establish a clearer and more appropriate causal relationship between disorders and etiological factors, long-term prospective follow-up studies are necessary. In this study, social cognitive abilities such as emotion recognition and theory of mind were assessed; however, executive functions and other neurocognitive abilities were not evaluated. Additionally, IQ levels were assessed clinically, and no standardized intelligence test was administered. Our study revealed significant disparities between the substance-using and non-using groups regarding sociodemographic characteristics, particularly parental education and family income. While subgroup analyses were performed, these differences may nonetheless have influenced the outcomes. Furthermore, the non-randomized design of the study constitutes an additional limitation, reducing its internal validity. Consequently, the results should be interpreted with caution, considering that the substance-using group originated from a comparatively disadvantaged background.

The amount of substance use in the SUD group may have an impact on social cognitive impairment. However, due to the heterogeneity within the study group—stemming from differences in consumption forms such as standard drinks, pills, or grams—the relationship between quantity of use and test scores could not be evaluated.

Some adolescents in the substance use disorder (SUD) group were on medication at the time of participation. Psychotropic medications such as antipsychotics, antidepressants, and sedatives—which can influence attention—may have affected test performance. Furthermore, higher levels of depression and anxiety symptoms observed in the SUD group may also have influenced test performance. Moreover; It should be kept in mind that different types of substances may exert different effects. Although a subgroup analysis was conducted, substance-specific analyses could not be performed due to the heterogeneity of the substance-using groups.

CONCLUSION

This study is one of the few in the literature that examines social cognitive skills in adolescents with SUD. Adolescents with substance use disorder have significant impairments in both facial emotion recognition and ToM abilities compared with individuals in the control group. The similarity of the findings in early life to those observed in adulthood suggests that impairments in social cognitive abilities may serve as a predisposing factor for substance use disorder. To obtain more accurate and generalizable results, larger-scale prospective longitudinal studies are needed.

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Data collection: ROÇ, ES
Data analysis: ROÇ
Study supervision: ES, ŞA
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