

## Theory of mind deficit in adolescents with major depressive disorder

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### ABSTRACT

**Objective:** This study aims to investigate the two aspects of ToM (social-perceptual and social-cognitive) by comparing patients with major depressive disorder with in adolescents a healthy control group. **Methods:** The study included 30 adolescent patients with major depression and 31 healthy volunteers matched with patients in terms of age and educational stage. All participants were administered a form for sociodemographic and clinical information and then Kiddie-SADS (Kiddie-Schedule for Affective Disorders and Schizophrenia), Kovacs Children's Depression Inventory (CDI), The Screen for Child Anxiety Related Disorders (SCARED), Wechsler Intelligence Scale for Children-Revised (WISC-R), Smarties Test, Ice Cream Van Test, Hinting Test and Eyes Test were performed. **Results:** ToM deficit was found in patients diagnosed with major depressive disorder. There was a significant difference between the two groups in the parameters of the CDI, SCARED, Ice Cream Van test, Hinting test, and Eyes test. The WISC-R verbal scores of the patients were significantly correlated with the Eyes test. There was a significant relationship between the patients' depression scale for children and the ice cream van test. **Conclusion:** In addition to the literature, this study showed us that both dimensions of ToM may be impaired in adolescents with major depression. (*Anatolian Journal of Psychiatry* 2020; 21(2):158-164)

**Keywords:** theory of mind, adolescent, major depressive disorder

## Majör depresif bozukluğu olan ergenlerde zihin kuramı bozukluğu

### Öz

**Amaç:** Bu çalışmada majör depresif bozukluğu olan ergen hastaları sağlıklı kontrol grubu ile karşılaştırarak zihin kuramının (ZK) iki boyutunu (sosyal-algısal ve sosyal-bilişsel) araştırmak amaçlanmıştır. **Yöntem:** Majör depresyonu olan 30 ergen hasta ve yaş ve eğitim düzeyi olarak uyumlu 31 sağlıklı gönüllü çalışma kapsamına alındı. Tüm katılımcılara Sosyodemografik ve Klinik Bilgi Formu verildi ve ardından Kiddie-SADS (Duygusal Bozukluklar ve Şizofreni için Çocuk Programı), Kovacs Çocuk Depresyon Envanteri, Çocukluk Kaygılarına İlişkin Bozukluklar Ekranı, Wechsler İstihbarat Çocuk Gözden Geçirilmiş (WISC-R), Smarties Testi, Dondurma Van Testi, Renklendirme Testi ve Göz Testi için ölçek uygulandı. **Bulgular:** Majör depresif bozukluğu olan hastalarda zihin kuramı eksikliği bulundu. Kovacs Çocuk Depresyon Envanteri, Çocukluk Kaygılarına İlişkin Bozukluklar Ekranı, Dondurmalı Kamyon Testi, İma Testi ve Gözler Testlerin sonuçları açısından her iki grubun arasında anlamlı farklılık vardı. Hastaların WISC-R sözel sonuçları ile Gözler test sonuçları arasında anlamlı korelasyon vardı. Hastaların Kovacs Çocuk Depresyon Envanteri ile Dondurmalı Kamyon test sonuçları arasında anlamlı ilişki vardı. **Sonuç:** Bu çalışma alan yazına ek olarak bize majör depresyonu olan ergenlerde ZK'nın iki boyutunun da bozulabileceğini göstermiştir. (*Anadolu Psikiyatri Derg* 2020; 21(2):158-164)

**Anahtar sözcükler:** Zihin kuramı, ergen, majör depresif bozukluk

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## INTRODUCTION

Major depression is one of the most common mental disorders in many countries.<sup>1</sup> It is highly recurrent: The patients with a depressive episode (at least 50%) will have at least one episode in their lives, and approximately 80% of patients with two episode histories will experience another relapse. Therefore, major depression is one of the leading causes of years of inadequacy worldwide, so it is important to investigate the factors that prevent depressive disorders.<sup>2</sup> The deterioration of social, perceptual, cognitive, and reasoning skills causes functional impairment in patients. Successful social interaction relies on various cognitive skills, including perception, motivation, correct interpretation of social signals, attention and decision-making. Social cognition demonstrates all of the abilities that allow the flexible management of social behavior and the projection of the relationship between self and others.

Since interpersonal disorders are very common in people suffering from depression, a more comprehensive understanding of the cognitive mechanisms underlying these social deficits is crucial. A concept used to comprehend impaired social functioning in individuals with depression is theory of mind (ToM). ToM dysfunction is defined as a key feature in schizophrenia<sup>3</sup> and autism<sup>2</sup> and it is also related to other psychiatric disorders such as borderline personality disorder (BPD), anorexia nervosa, or bipolar disorder.<sup>4</sup> ToM, a key aspect of social cognition, expresses one's ability to judge the mental state of one's own and more religious people, such as intentions or beliefs.<sup>4</sup>

Various methods have been used in literature to test the ToM. Studies have modeled different aspects of the ToM and have demonstrated that a model composed of the ability to test false beliefs, recognize faux pas, and understand hints had the highest capability to separate patients and healthy groups. The ToM is composed of the following components: first order false belief, second order false belief, metaphor comprehension, irony comprehension, and faux pas comprehension skills. The first order of ToM is developed at the age of 4-5 and is defined as the ability to discern the misconceptions of others.<sup>3</sup> It allows the person to understand what they know about reality and understand what others do not know and misunderstand.<sup>5</sup> First order ToM is tested with first order false belief tasks. The second order of ToM is defined as 'thought about thought' or 'belief about belief'<sup>6</sup>

which is the person's ability to recognize someone else's thoughts of an event or thoughts of a third person's opinions and to understand that they are wrong<sup>5</sup> and develops in children 6-7 years of age. Second order false belief tasks implemented by Wimmer and Penner are used to test the skills of second order ToM.<sup>7</sup> The ability to grasp metaphor and irony, is a more complex and precise ToM ability, and includes abstract interpretation, or interpretation of figurative speech. The literal meaning of the speech must be set aside to understand the speaker's true intentions.<sup>8</sup>

The results of recent research in patients with major depressive disorder are contradictory. Many studies have found that social-perceptual and social-cognitive abilities in patients with major depressive disorder are significantly lower than those of healthy volunteers.<sup>9,10</sup> There are also studies that render literature results as irrelevant.<sup>11</sup> The main purpose of this study was to evaluate ToM between the control group and young adult patients with major depressive disorder. However, the relationship between ToM and criteria such as the number of hospitalizations, the number of suicide attempts, the duration of the disease and the severity of symptoms will also be evaluated.

## METHODS

The study was approved on September 29, 2015 by the Ethics Committee of Uludağ University Medical Faculty (decision number 2015-17/35). The study group was selected among the patients who applied to the Child and Adolescent Psychiatry Outpatient Clinic of Uludağ University Faculty of Medicine between October 2015 and May 2016. Subjects of the study were selected among patients aged 12 to 17 years, who were diagnosed with major depressive disorder according to DSM-5.<sup>12</sup> The study group was composed of 30 adolescent (nine male, 21 female) patients diagnosed with major depressive disorder according to DSM-5 (Diagnostic and Statistical Manual of Mental Disorders). The control group was composed of 31 control subjects (13 male, 18 female) with no psychiatric diagnosis or other medical disease (inclusion criteria).

All participants of the study were informed both verbally and in writing of the purpose of the study (Informed Volunteer Form). The control group was composed of relatives of the hospital staff and researchers. Individuals without any psychiatric disorder, serious physical or neurological

disease, and who did not have a history of drug use within the last month that could affect cognitive function were included in the control group. Major depressive disorder patients were matched with healthy volunteers control group in terms of age and duration of education.

The interview was initiated by filling in questionnaires with sociodemographic and clinical information about the patient. Subsequently, the Kiddie-SADS (Kiddie-Schedule for Affective Disorders and Schizophrenia) was administered to assess the presence of another psychiatric disorder in the patient and control group<sup>13</sup>. Adolescent patients with major depressive disorder and no other comorbid diagnosis according to DSM-V criteria and members of the control group with no psychiatric diagnosis continued with the study while those detected with psychiatric disease were excluded from the study.

WISC-R was administered by a clinical psychologist to all participants.<sup>14</sup> According to results of the WISC-R test, those who scored below normal limits in verbal, performance, and total IQ, or had a difference greater than 15 between verbal and performance scores were excluded from the study. Patients with an organic brain pathology, substance and alcohol abuse or history of addiction, drug use (benzodiazepine etc.) likely to affect cognitive function, and patients with Axis I psychopathology other than major depressive disorder were also excluded from the study.

**Smarties (Bonibon) Test:** An unexpected content test was used to evaluate first order false belief, developed by Hogrefe, Wimmer and Penner.<sup>15</sup> The Turkish translation and reliability study was done by Girli and Tekin.<sup>16</sup> It also has a certain shape of box which can be easily recognized by children. A crayon put in bonibon box. The bonibon box show to the child and ask two control questions; 'What is this?' and 'What is in it?' For these questions child should give answers 'bonibon box' and 'bonibon'. For these questions answers like 'jelibon', 'chocolate' are also accepted.

**Ice Cream Van Test:** The Ice-Cream Van Test, was developed by Perner and Wimmer in 1985.<sup>17</sup> The Turkish translation and reliability study was done by Girli and Tekin.<sup>16</sup> This test has a story, while telling its story we also showed pictures on cards. 'Meltem and Can are in the park. Can wanted to buy ice cream from the ice cream van but he hasn't got any money. The ice cream man tells her that he will be there all afternoon. Can goes off home to get money for

ice cream. After that, ice cream man tells Meltem that he changed his mind and he is going to drive to the school yard and sell ice cream there. Ice cream man sees Can on the road of the school and he also tells him that he is going to the school yard and will sell ice cream there. Meltem goes to Can's house but Can is not there. His mom tells her that he has gone to buy ice cream. Where does Meltem think Can has gone, to the school or to the park? And a control question asked 'Where did Can go to buy ice cream?'

**Hinting Test:** This test was developed by Corcoran et al; the participants are given 10 short stories which are read by the administrators.<sup>18</sup> Each short story includes one of story characters giving another a hint. The participant is asked what that character really meant to say. The correct answer is 2 points. If answered incorrectly, a clearer hint is given and the participant is asked for a second time. A correct answer in this phase is 1 point; a wrong answer is 0 points, and the next story is passed.

The test has a good 'superficial validity' for this population and has been used in many studies to assess the deficits of ToM in schizophrenia.<sup>18-20</sup>

**Eyes Test:** The Children's version of this test was developed by Baron Cohen et al. In 1997 to measure social cognitive abilities in children with autism.<sup>21</sup> In 2001, it was revised by Baron Cohen et al. to include 28 photographs of male and female eyes, and a version suitable for use for children was developed. This test is designed to test how well the participant can show empathy and form assumptions on the mental state of others.<sup>22</sup> The Turkish version of this test by Alev Girli was used in this study.<sup>16</sup>

**Kovacs Depression Scale for Children (CDI):** A self-assessment scale used to measure the level of depressive symptoms and change in severity, in order to determine the subject's risk of depression developed by Kovacs in 1981. The self-assessment test applicable to children aged 6-17 includes 27 items.<sup>23</sup> The validity and reliability study in our country was conducted by Öy and the pathological cut-off score was defined as 19 points.<sup>24</sup>

**Screen for Child Anxiety Related Disorders (SCARED):** The Screen for Child Anxiety Related Disorders (SCARED) was developed by Birmaher et al.<sup>25</sup> and measures the frequency of the anxiety symptoms experienced by the individual. A score above 25 points is indicative of anxiety disorder. The Turkish validity and reli-

bility study was conducted by Çakmakçı,<sup>26</sup> consists of 41 items.

**Weschler Intelligence Scale for Children (WISC-R):** The WISC for children aged 6-16 years was developed by David Weschler in 1949. This scale was reviewed in 1974 and standardized as the WISC-R (Revised Version).<sup>27</sup>

### Statistical analysis

Statistical analysis of the data was performed using the SPSS 20.0 statistical package program. Descriptive statistics for categorical variables are provided as n and %. Pearson's and chi-square and Fisher Freeman Halton Tests were used to compare categorical variables between groups. Independent sample t-test and one-way analysis of variance (ANOVA) were used for comparison of the groups with normal distribution. For the analysis of variance, Tukey Test was used for multiple comparisons. Mann

Whitney U Test and Kruskal Wallis Test were used for comparison of the variables with no normal distribution. The level of significance was set at  $p < 0.05$ .

### RESULTS

A total of 61 volunteers between the ages of 12-17 were included in the study. Of these, 30 were in the patient group, while 31 were in the control group. The patient group consisted of 21 females and nine males, while the control group consisted of 18 females and 13 males.

There was no significant difference between groups in terms of gender difference, education level, on who they lived with and their place of birth.

The sociodemographic characteristics of the patients and control group included in the study are shown in Table 1.

**Table 1.** Sociodemographic characteristics of the patient and control groups

	Patient group		Control group		p
	n	%	n	%	
Age (mean±SD)	13.73±1.48		13.37±1.32		0.303
Gender					
Male	9	30.0	13	42.0	0.476
Female	21	70.0	18	58.0	
Socioeconomic status					
Low	7	21.0	1	3.2	<b>0.027</b>
Lower-middle	15	50.0	19	61.3	
Upper-middle	5	15.0	11	35.5	
Upper	3	9.0	0	0.0	
Family structure					
Nuclear	17	56.7	25	80.6	<b>0.049</b>
Extended	8	26.7	2	6.5	
Parents divorced	5	16.7	4	12.9	
Place of birth					
City	26	86.7	27	87.1	>0.05
Town	4	13.3	4	12.9	
Place of residence					
City	28	93.3	31	100.0	>0.05
Town	2	6.7	0	0.0	

The values of the results of the CDI (Kovacs Children's Depression Inventory), SCARED, Smarties Test, Ice Cream Van Test, Hinting Test, Eyes Test, and WISC-R are shown in Table 2. There was a significant difference between the two groups in the parameters of the CDI, SCARED, Ice Cream Van test, Hinting test, and Eyes test ( $p < 0.05$ ). There was no significant difference in the scores of the Smarties test and

WISC-R ( $p = 0.906$ ). The median, minimum and maximum scores of the groups are shown in Table 2.

### Correlation between Eyes Test and WISC-R

The correlation between the Eye Test and WISC-R total, WISC-R verbal, and WISC-R performance scores were assessed in the patient group. There was no significant correlation

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**Table 2.** Test scores of the patient and control groups

	Patient	Control	p
CDI	51 (40-58)	14 (5-18)	<b>&lt;0.001</b>
SCARED	37 (27-65)	13 (1-18)	<b>&lt;0.001</b>
Smarties Test	30	30	1.0
Ice Cream Van Test	8	20	<b>0.007</b>
Hinting Test	15 (4-18)	19 (17-20)	<b>&lt;0.001</b>
Eyes Test	16	21	<b>&lt;0.001</b>
WISC-R	104	108	>0.05

CDI: Kovacs Children's Depression Inventory; SCARED: The Screen for Child Anxiety Related Disorders; WISC-R: Wechsler Intelligence Scale for Children-Revised

**Table 3.** Relationship between the Eyes test and WISC-R for the patient group

	WISC-R total	WISC-R performance	WISC-R verbal
Eyes Test	r=-0.200 p=0.289	r=-0.357 p=0.053	r=0.737 <b>p&lt;0.001</b>

WISC-R: Wechsler Intelligence Scale for Children-Revised

between WISC-R performance and total scores and the Eyes Test ( $p = 0,530$ ) ( $p = 0,289$ ). The WISC-R verbal scores of the patients were significantly correlated with the Eyes Test ( $r=0.737$ ,  $p<0.001$ , Table 3).

#### The correlation between the patient group Depression Scale for Children and the Scores of Eyes Test, Hinting Test and Ice-Cream Van Test

There was no significant relationship between CDI and Eye Test and Hinting Test ( $p=0.169$ ,  $p=0.928$ , respectively).

In the patient group, there was no significant correlation between the number of hospitalizations, history of suicide, duration of last episode, Eyes Test, Hinting Test, Smarties Test and Ice Cream Van Test ( $p>0.05$ ).

There was a significant correlation between the patients CDI and the Ice Cream Van Test ( $p<0.05$ , Table 4).

**Table 4.** Relationship between the Ice Cream Van Test and Children's Depression Inventory (CDI)

Ice Cream Van Test	CDI	p
Successful (range)	46 (40-52)	<b>0.05</b>
Unsuccessful (range)	53 (44-58)	

## DISCUSSION

In this study, Smarties Test for first order ToM measurement, Ice Cream Van Test for second order ToM measurement, Hinting Test for comprehension of irony, and the Eyes Test was used to evaluate social perception. The success rate of the patient group was lower in the other tests except for the Smarties Test. This has shown us that depressed patients do not have difficulty in fulfilling the simpler task of first-order ToM, but cannot perform tasks requiring second-order ToM, irony recognition, and recognition of emotions (social perception), which are more complex tasks. Our findings are consistent with the results Kerr et al.<sup>11</sup> studied on adults. They stated that this was due to the low sensitivity of first-order ToM.

The relationship between SCARED scores of the patients and the scores of the ice cream truck test, the hinting test, and the eyes test were assessed and the anxiety levels of the adolescent patients with depression were not correlated with the ToM deficit. This has led us to believe that major depressive disorder in adolescents causes deficit of ToM independent to the presence of anxiety symptoms. Patients with impaired ToM have difficulties in adapting to everyday life and suffer social problems.<sup>11</sup>

There was no significant difference between WISC-R total, verbal and performance scores of

control group and adolescents with major depressive disorder. A significant correlation was found between WISC-R verbal score and Eyes test. This finding is consistent with the study by Wolkenstein et al.,<sup>28</sup> which demonstrates that the ability to combine conceptual knowledge about humans is effective on the theories of ToM.

When the literature is examined, there are many studies on adult patients with major depressive disorder. However, the fact that this is the first study to evaluate ToM deficit in child and adolescent patients with major depressive disorder makes our study all the more valuable.

There are some limitations in our study: First,

sampling was not randomized. Second, for the patient group of participants, it would be better to increase the number of participants for further studies.

In conclusion, we have found that adolescents with major depressive disorder have a deficit of ToM independent of anxiety levels. ToM deficit appears to be an important factor that distinguishes adolescent individuals with major depressive disorder from healthy ones, no matter their characteristics. This suggests that the theoretical deficit of ToM occurs in the major pathology of major depressive disorder and independently affects the presence of the pathology independently of other features.

**Authors' contributions:** Ş.K.: finding topic, literature review, study design, execution, data analysis, article writing; O.K.: data collection, literature review, contribution to article writing; A.P.V.: Data collection, analysis of data, contribution to article writing.

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