ORIGINAL ARTICLE

Theory of mind in adolescents with Attention-Deficit Hyperactivity Disorder: A cross-sectional study

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Abstract

Objective

Attention-Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder that may be associated with impaired Theory of Mind (ToM) and social cognition. ToM is a domain in social cognition, referring to one's ability to attribute beliefs, intents, perspectives, and understandings to oneself or others and to understand others' mental states.

Materials & Methods

The present study enrolled 52 ADHD of adolescents and 41 healthy age-matched controls in this study. This study applied The Reading the Mind in The Eyes Task (RMET) and Theory of Mind Assessment Scale (Th.o.m.a.s.) for all participants. The results of these tasks were compared between the two study groups.

Results

No significant differences were found between these two study groups regarding ToM abilities using mean scores in the Th.o.m.a.s. inventory and the RMET. Furthermore, no association was found between the mean score in the ToM (in both study groups) and this study's parameters of gender, mean age, birth rank, family structure, and income.

Conclusion

This study did not support the hypothesis that adolescents with ADHD perform worse on ToM tasks.

Keywords: Attention-Deficit Hyperactivity Disorder; Theory of mind; Adolescents; Social cognition
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Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders. Patients may be hyperactive, impulsive, and inattentive. It is usually first diagnosed in childhood and may continue into adulthood. Besides, these symptoms begin at an early age and vary among different developmental stages (1). ADHD is also known to cause impaired social cognition and inappropriate social behaviors (2, 3). Additionally, studies suggest that emotional dysregulation in children patients can contribute to impaired social interactions (4). These children suffer from impairments in mutual friendships, may have passive and disengaged behaviors, have difficulty interacting with peers, and may be rejected (5). Children with ADHD often experience conflicts in the family due to the inability to empathize with others (6, 7). This is an essential issue since social interactions with peers, mutual friendships, and being accepted in society play fundamental roles in the development of children

Recent studies suggest that ADHD may be associated with an impaired ToM (4). The ToM concept was first introduced by Premack et al. in 1978(8). ToM is a domain in social cognition that refers to an individual's ability to attribute beliefs, intentions, views, and perceptions to oneself or others and to understand that others have diverse mental states toward oneself. Understanding social cues, humor, sarcasm, and metaphors in social situations is another aspect of ToM. The prefrontal cortex of the human brain is the main area that affects ToM (1). Therefore, any structural or functional impairment in this region may lead to an impaired ToM. Neuroimaging studies have shown evidence of cerebellar and frontal cortex abnormalities in patients with ADHD, which can impair social cognition and may contribute to an impaired ToM (1, 3).

To our best knowledge, a few studies have assessed ToM in adolescent patients with ADHD in order to help better understand the association between ADHD and deficiencies in ToM. Hence, this cross-sectional study investigated ToM among a group of adolescents with ADHD and healthy age-matched controls and compared the results.

Materials & Methods

This cross-sectional study enrolled 52 adolescents with ADHD and 41 healthy age-matched controls. This research recruited all pediatric patients with ADHD between 12 to 18 years old from districts 1 and 14 of Tehran, Iran, who were new cases from January 2021 to December 2021. The diagnosis of ADHD was made by a child and adolescent psychiatrist in charge of the project, based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) using the Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL) , in order to assess for ADHD and other psychiatric disorders and comorbidities. All patients were drug naïve. The exclusion criteria were determined as having a disabling physical illness, including neurological disorders, speech disorders, substance use, psychiatric medication use, cognitive disability, visual and hearing impairments, Obsessive-Compulsive Disorder (OCD), Autism Spectrum Disorders (ASD), schizophrenia, and mood disorders. In order to select the subjects for the control group, we randomly selected six high schools among the schools in districts 1 and 14 in Tehran, Iran (the schools for children with special needs were excluded) and randomly selected 41 age-matched

students among all of which did not meet diagnostic criteria for ADHD. ADHD rating scale was used as a screening tool completed by caregivers, and in the next step, a psychiatric interview using K-SADS-PL was done for all of them to exclude ADHD and other relevant exclusion criteria. The exclusion criteria for both groups were similar. After obtaining written informed consent from all participants and their caregivers, the sociodemographic information form designed for this study was completed by the parents. This form included the following data: age, gender, birth rank, number of siblings, parent's level of education, and family socioeconomic status. In order to assess ToM, this study used the RMET and Th.o.m.a.s. The results of these questionnaires were compared between the two groups and analyzed.

Questionnaires

Th.o.m.a.s.

Th.o.m.a.s. consists of 37 open-ended questions that investigate the most basic mental states, including positive and negative emotions, desires and intentions, knowledge, and beliefs. During this interview, the interviewees are asked to explain and discuss their answers along with examples. The questions are in four domains consisting of Scale A (I–Me)—First-order first-person ToM, Scale B (Other–Self)—Allocentric third-person ToM, Scale C (I–Other)—Egocentric third-person ToM, and Scale D (Other–Me)—Second-order first-person ToM. The questions in each domain are divided into three subscales: awareness, relation, and realization. The validity and reliability of the Farsi form of this test were tested at the Payame Noor University, Tehran, Iran, with a target population of 100 students. For checking validity and reliability, the questionnaire was first investigated for face validity by a group of experts, and then filled out by 31 students of Payame Noor University, Tehran, Iran. The reliability coefficient was measured as 84% using Cronbach's alpha internal consistency method, indicating this test has high reliability for assessing ToM.

The Reading the Mind in the Eyes task (RMET)

This test was first introduced by Baren-Cohen et al. to measure the social skills of children with ASD (9). This study used the pediatric version of this test, consisting of 28 items, each with four options; one of the four options is considered correct. This test measures the ability to decipher individuals' mental or emotional states by looking at a photo of their eyes. The Farsi translation, along with its validity and reliability measurement, is conducted in a study by Zabihzadeh et al. (10).

ADHD rating scale: The ADHD rating scale, reported by parents and teachers, was designed by DuPaul et al. (11). This questionnaire consists of 18 to 90 questions asking about the child's behavior over the past six months and is used in children between the ages of 5 and 17. The current study used the Farsi translation of this questionnaire. Mousavi et al. tested the Farsi version of this questionnaire for reliability and validity (12).

K-SADS-PL: K-SADS-PL is a semi-structured interview that can detect psychiatric disorders in children and adolescents based on DSM-V criteria. These disorders include depression, bipolar disorder, mania, anxiety disorder, and OCD (13). This semi-structured interview lasts about 45 to 75 minutes and comprises six parts. In 2010, it was translated into Farsi, and its reliability and validity were investigated in a study by Shahrivar et al. Accordingly, this research used translated version (14).

Ethics

This study was conducted under the declaration of Helsinki. Besides, informed consent was obtained from all participants and their families. In addition, the study protocol was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences. All patients entered the treatment process after the tests.

Statistical analysis

After data collection, data analysis was performed using SPSS version 25. All qualitative and quantitative variables were described along with their count, percentage, and mean ±SD. The normality of continuous data was evaluated using the Kolmogorov-Smirnov test. In order to analyze measures, ANOVA, t-test, and Chi-Square tests were used. In the case of abnormally distributed data, this study used the Mann-Whitney and Kruskal Wallis tests. Pearson correlation coefficient was used to measure the relationship between quantitative variables, and in case of abnormal data distribution, the Spearman correlation coefficient was used. A p-value of less than 0.05 was considered statistically significant in all data analyses.

Results

Demographic data

The present study enrolled 52 patients with ADHD and 41 healthy age-matched controls in our study. Sociodemographic data are summarized in Table1. As indicated in Table1, the frequency of male participants was significantly higher in the ADHD group (P-value < 0.05). Given that the literature suggests that ToM may vary between the sexes, this study justified the effect of the gender variable using statistical methods. No significant difference was found between the two groups regarding mean age, birth rank, parents' education, and income. (Table1)

Th.o.m.a.s.

The current study divided the level of performance in this test into four subgroups: low ability, acceptable ability, optimal ability, and very high ability. No relationship was seen between the study groups and the frequency of different performance levels. (P-value > 0.05) In both study groups, the most frequent performance level (ADHD: 86.5%, control: 82.9%) was "optimal ability," and more than 10% of the participants in each group showed a "very high ability" in this test.

The mean score of this test was 83.66 ± 10.33 in the ADHD group, and 86.42 ± 12.52 in the control group, and this research found no significant differences between the two groups. (P-value > 0.05) (Table-2)

This study analyzed the mean Th.o.m.a.s. scores in each study group by classifying study groups based on male and female subgroups, one-child and multi-child families, different birth ranks of participants, and different parental education levels.

Due to this study's analysis, there were no significant differences among these subgroups regarding the mean Th.o.m.a.s. score. (P-values > 0.05)

Similarly, the current study calculated the mean score in each Th.o.m.a.s. subscale in both study groups and analyzed the presence of any significant differences. No significant differences were found between the two study groups regarding the mean Th.o.m.a.s. score in each subscale. (P-value > 0.05) (Figure1)

The Reading the Mind in the Eyes task (RMET)

The mean score of this test was 48.75 ± 10.73 in the ADHD group and 48.77 ± 11.14 in the

control group, and this study found no significant differences between the two groups. (P-value > 0.05) (Table- 2)

Moreover, this investigation calculated possible correlations between the mean score of the Th.o.m.a.s. test and several study parameters in each study group using the Spearman's correlation coefficient, provided the Spearman's correlation coefficient (r) along with the respective p-values for each parameter in Table3. As indicated in Table3, there were no significant correlations. (P-values > 0.05) (Table-3)

Table 1. Comparison of Sociodemographic data of ADHD and Control groups

Study Parameters	ADHD (n=52)	Control (n=41)	P-value
Mean age	14.05 ± 1.81	14.32 ± 2.49	ns
Gender (male)	59.6% (31)	29.6% (12)	<0.05
Family Structure One-child family	42.3% (22)	22% (9)	<0.05
Multi-child family	57.7% (30)	78% (32)	ns
Birth Rank First	71.2% (37)	60.5% (25)	ns
Second	21.2% (11)	36.8% (15)	ns
Third or more	7.7% (4)	2.6% (1)	ns
Education (associate degree and bachelor's degree) Mother	42.3% (22)	36.8% (15)	ns
Father	47.1% (24)	36.8% (15)	ns
Income (medium)	55.8% (29)	52.6% (21)	ns

ns: nonsignificant

Table 2. Mean scores of Th.o.m.a.s and The Reading the Mind in the Eyes task:

Mean Test Scores	ADHD(n=52)	Controls(n=41)	P-value
Th.o.m.a.s	83.66 ± 10.33	86.42 ± 12.52	ns
The Eye's test	48.75 ± 10.73	48.77 ± 11.14	ns

ns: nonsignificant

Table 3. Correlations between ToM score and several study parameters using Spearman's correlation coefficient

	Mean age (p-value)	Gender (p-value)	Family Structure (p-value)	Birth rank of subjects (p-value)	Family Income (p-value)
ADHD mean ToM score	0.114 (ns)	-0.133 (ns)	-0.001 (ns)	-0.05 (ns)	-0.142 (ns)
Controls mean ToM score	0.287 (ns)	-0.025 (ns)	0.218 (ns)	0.068 (ns)	-0.313 (ns)

ToM score: Th.o.m.a.s score, Eye's test score: The reading the mind in the eyes task score, ns: nonsignificant,

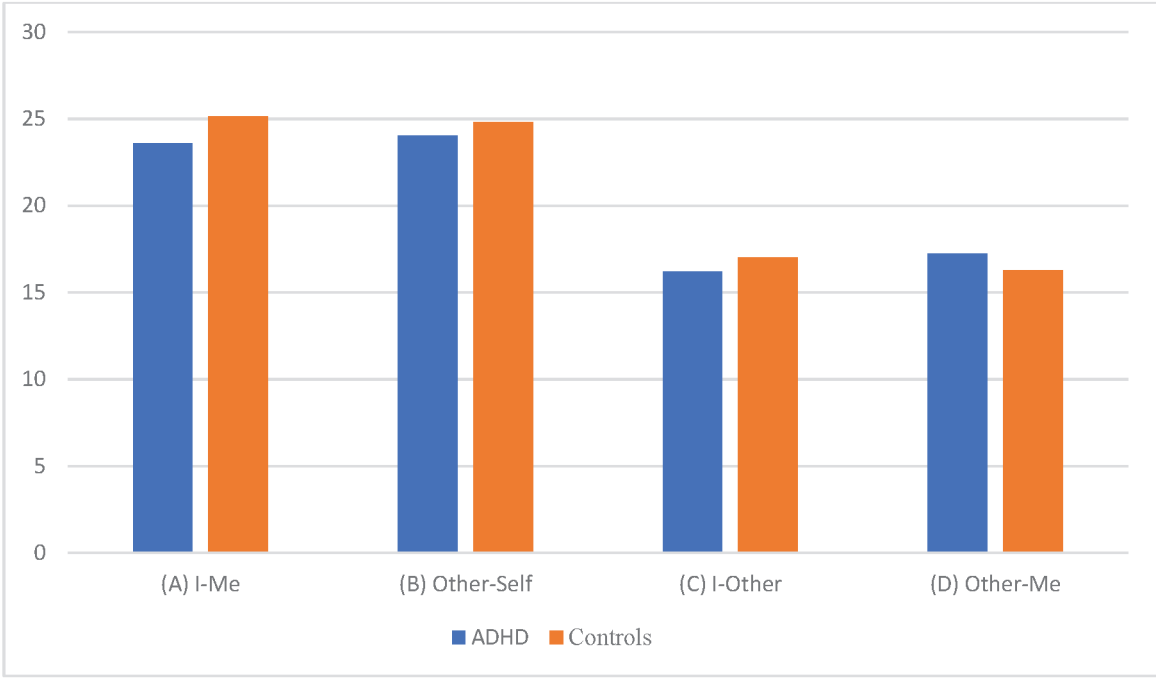

Figure 1. *ADHD vs. controls: mean scores at the individual scales*

Discussion

This cross-sectional study enrolled adolescent patients with ADHD along with healthy age-matched controls to compare ToM abilities using two previously approved tasks: Th.o.m.a.s. and the RMET. The obtained results showed no significant differences between the two groups regarding ToM abilities regarding the scores in the RMET and subscales of the Th.o.m.a.s. test. More than 80% of the participants in both groups showed an optimal level of performance in the Th.o.m.a.s. test. No correlation was observed between the mean ToM scores and study parameters of gender, mean age, birth rank, family structure, and income. Most studies indicate that ADHD is associated with impaired ToM skills. However, some studies in the literature have found similar findings to ours.

This study found no association between an ADHD diagnosis and performing poorly in the Reading the Mind in the Eyes task (the Eyes test). However, reviewing the literature indicated that several previous studies have found different results.

Saeedi et al. 2014 study using the RMET showed that ADHD in children could be associated with impaired ToM (1).

The study by Mary et al. in 2016 also showed

similar results, reporting that children with ADHD perform more poorly in the Eyes task when the data was not controlled for inhibition and attention variables (15).

In another study, Baribeau et al. indicated that the Eyes task scores vary among children with different neurodevelopmental disorders. They reported that the scores of children with ADHD were lower than the control and the OCD group (16).

In a 2021 study in Turkey, Kılınçel showed impaired second-order social cognition skills in adolescents with ADHD using Faux Pas Recognition, Smarties, and Ice Cream Truck test. Impaired ToM in these patients was related to the severity of ADHD symptoms. ToM is a subset of social cognition and has different levels. The first-and second-order operations of ToM are related to social cognition skills (17).

First-order skills define as taking the perspective of another person (18). Second-order skills define as taking the perspective of another person who is taking the perspective of another agent (one's beliefs about the content of others' minds, beliefs, and intentions) (17).

Social cognition is defined as reasoning and interpreting information from the social environment, understanding others' feelings and thoughts, and interpreting their behaviors and intentions, which is essential for social interactions (19). TOM, on the other hand, is the ability to interpret the opinions and intentions of others and realize wrong intentions, sarcasm, jokes, ploy, and figure of speech (20). Realizing that the patients do not know they should not say those words is related to this cognitive part of ToM (3). Previous studies have shown that family structure, number of siblings, physical illnesses, and unfortunate life events such as socioeconomic problems and divorce affect the cognitive skills of ToM, predominantly second-order skills (3).

The emotional part of ToM is related to the ability to recognize the MSE of others through the information observed and empathy with the other person. Evaluation of this part is done by the RMET (10).

In a study by Mary et al. using the RMET and Faux Pas, it was reported that children with ADHD had significantly lower scores in both ToM tasks compared with healthy control children. They also found a unidirectional relationship between ToM scores, inhibition, and attention variables. This finding suggests that attentional deficits and issues related to executive function may explain ToM disruptions in ADHD children (15).

In another 2017 study by Moaz et al., ToM and empathy were assessed by the Faux Pas task and Interpersonal Reactivity Index (IRI) questionnaire; respectively, they reported that children with ADHD performed more poorly in both Faux Pas and IRI tasks. They also revealed that after the administration of methylphenidate, children's performance with ADHD on the Faux Pas task improved and was equal to healthy controls (5).

The executive function of the brain and problems with concentration and impulsivity are related to the emotional component of TOM. Previous studies showed that the maturation of executive function dimensions is related to increased emotional understanding (in oneself and others) and emotion regulation. Given that ADHD is associated with EF deficits, these patients are expected to have problems with the emotional component of ToM. Perhaps patients with ADHD have difficulty answering the eye test because they do not pay enough attention during this test (21).

In the present study, patients with ADHD sat

at a computer next to a child and adolescent psychiatrist and did the test in the morning from 8 a.m. to 12 a.m. Participants were asked to go to bed on time the night before, eat breakfast on the morning of the assessment, and not to come if they had non-specific physical symptoms. They wore headphones, environmental stimuli were removed, and the therapist sat beside them as an authority. This was the first time they had seen a psychiatrist, and no psychiatric diagnosis had been given so far. The schools did not have any serious complaints, but the families recalled that their adolescents had symptoms since childhood, so these adolescents may not have serious problems. Perhaps that is why the obtained results differ from those of previous studies; they may have responded better in this structured environment and the therapist's presence.

In 2019, a study by Abdel-Hamid et al. noted that ToM skills could improve and change with age (22).

This research's participants were adolescents, and given that ToM develops with age, we can expect our executive neuropsychiatric assessment results to be better than those of children. Maybe that is why children have more ToM problems than adolescents.

The association between EF and ToM in ADHD has been seen in studies (23).

Moreover, in a 2016 study, Alison Mary et al. indicated that in ADHD, EF deficits and attentional problems are responsible for impaired ToM (15).

Abdul Hamid's 2019 study on adults explained that ADHD patients had EF and empathy problems but no prominent ToM problems. Suppose problems with ToM in adult ADHD were unrelated to EF, possibly due to comorbidities. Social cognition was not significantly different. Empathy and ToM are two independent components of social cognition. This study noted that empathy is more associated with Executive Function than ToM (22).

A study by Bora et al. in 2016 showed that social cognitive deficits could be improved by neurodevelopment or further experience during adolescence, but empathy skills are irreversible (2). Differences between this study's results and previous studies could be due to using different tools or inclusion criteria, such as different age ranges for enrollment and considering intelligence. Contrarily, Pitzianti et al. reported results similar to this study and showed that ToM abnormalities are not a constant finding in ADHD children. In this study, ToM was assessed using Development Neuropsychological Assessment-II (NEPSY-II) test. Besides, they investigated correlations between ToM and neurological soft signs and found no significant associations (14). In addition, two other studies have concluded that there is no certainty in finding ToM disabilities in children with ADHD; a study in 2009 and a study in 2002 both showed no significant difference between ADHD children and healthy individuals in their performance on ToM tasks (24, 25).

For the first time, this study used Th.o.m.a.s. inventory for assessing ToM abilities in a group of ADHD adolescents and compared their results to a group of healthy age-matched children. To our knowledge, no other studies have assessed ToM in adolescents with ADHD using the Th.o.m.a.s. scale, and differences in tests may affect the results. This research did not match the patients with ADHD and the healthy controls regarding IQ and educational level. Proposedly, further studies on ToM in ADHD adolescents need to be conducted with other tools, larger samples, and more strict inclusion criteria.

In Conclusion

The present study did not support the hypothesis that adolescents with ADHD perform worse on ToM tasks. Accordingly, this study suggests that more research needs to be done to reach a more definitive conclusion about ToM in ADHD.

Acknowledgement

None declare

Author's Contribution

KR, MK, RD and FA designed the study. MH did the executive work of the project. MH and MK analyzed and interpreted the patient data regarding the ToM tasks. GZ was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The Authors declare that there is no conflict of interest

References

1. Saeedi MTS, Noorazar G, Bafandeh H, Taheri M, Farhang S. Theory of mind in children with attention deficit hyperactivity disorder compared to controls. Journal of Research in Clinical Medicine. 2014; 2(3):99-104.
2. Bora E, Pantelis C. Meta-analysis of social cognition in attention-deficit/hyperactivity disorder (ADHD): comparison with healthy controls and autistic spectrum disorder. Psychological medicine. 2016; 46(4):699-716.
3. Kılınçel Ş. The Relationship between the Theory of Mind Skills and Disorder Severity among Adolescents with ADHD. Anatolian Journal of Psychiatry/Anadolu Psikiyatri Dergisi. 2021; 22(1).
4. Özbaran B, Kalyoncu T, Köse S. Theory of mind and emotion regulation difficulties in children with ADHD. Psychiatry research. 2018; 270:117-22.
5. Maoz H, Gvirts HZ, Sheffer M, Bloch Y. Theory of mind and empathy in children with ADHD. Journal of Attention Disorders. 2019; 23(11):1331-8.
6. Hoza B, Mrug S, Gerdes AC, Hinshaw SP, Bukowski WM, Gold JA, et al. What aspects of peer relationships are impaired in children with attention-deficit/hyperactivity disorder? Journal of consulting and clinical psychology. 2005; 73(3):411.
7. Alkire D, Levitas D, Warnell KR, Redcay E. Social interaction recruits mentalizing and reward systems in middle childhood. Human Brain Mapping. 2018; 39(10):3928-42.
8. Premack D, Woodruff G. Does the chimpanzee have a theory of mind? Behavioral and brain sciences. 1978; 1(4):515-26.
9. Bosco FM, Gabbatore I, Tirassa M, Testa S. Psychometric properties of the Theory of Mind Assessment Scale in a sample of adolescents and adults. Frontiers in psychology. 2016; 7:566.
10. Zabihzadeh A, Nejati V, Maleki G, Darvishi M, Radfar F. The Study of Relationship between mind reading ability and big five factors of personality. Adv Cogn Sci. 2012; 14(1):19-30.
11. DuPaul GJ, Power TJ, Anastopoulos AD, Reid R. ADHD Rating Scale—IV: Checklists, norms, and clinical interpretation: Guilford press; 1998.
12. Mousavi SA, Bazrafshan Z, Khosravi A. Validity and Reliability of Adult ADHD Self-Report Scale Persian Version (ASRS-V1. 1-Persian). International Journal of Health Studies. 2020; 6(1).
13. Kaufman J, Birmaher B, Brent D, Rao U,

Ryan N. Kiddie-Sads-present and Lifetime version (K-SADS-PL). Pittsburgh, University of Pittsburgh, School of Medicine. 1996:7000-00021.

14. Pitzianti M, Grelloni C, Casarelli L, D'Agati E, Spiridigliozzi S, Curatolo P, et al. Neurological soft signs, but not theory of mind and emotion recognition deficit distinguished children with ADHD from healthy control. Psychiatry research. 2017; 256:96-101.
15. Mary A, Slama H, Mousty P, Massat I, Capiau T, Drabs V, et al. Executive and attentional contributions to Theory of Mind deficit in attention deficit/hyperactivity disorder (ADHD). Child Neuropsychology. 2016; 22(3):345-65.
16. Baribeau DA, Doyle-Thomas KA, Dupuis A, Iaboni A, Crosbie J, McGinn H, et al. Examining and comparing social perception abilities across childhood-onset neurodevelopmental disorders. Journal of the American Academy of Child & Adolescent Psychiatry. 2015; 54(6):479-86. e1.
17. Astington JW, Pelletier J, Homer B. Theory of mind and epistemological development: The relation between children's second-order false-belief understanding and their ability to reason about evidence. New ideas in Psychology. 2002; 20(2-3):131-44.
18. Arslan B, Taatgen NA, Verbrugge R. Five-year-olds' systematic errors in second-order false belief tasks are due to first-order theory of mind strategy selection: A computational modeling study. Frontiers in psychology. 2017; 8:275.
19. Baron RA, Byrne D, Branscombe NR. Social psychology, 11/E. Aufl, Boston. 2006.
20. Yıldırım E, Alptekin K. Şizofrenide Öne Çıkan Yeni Bir Boyut: Sosyal Biliş. Dusunen Adam: Journal of Psychiatry & Neurological Sciences. 2012; 25(4).
21. Rueda MR, Paz-Alonzo P. Executive function and emotional development. 2018.
22. Abdel-Hamid M, Niklewski F, Heßmann P, Guberina N, Kownatka M, Kraemer M, et al. Impaired empathy but no theory of mind deficits in adult attention deficit hyperactivity disorder. Brain and Behavior. 2019; 9(10):e01401.
23. Pineda-Alhucema W, Aristizabal E, Escudero-Cabarcas J, Acosta-Lopez JE, Vélez JI. Executive function and theory of mind in children with ADHD: A systematic review. Neuropsychology Review. 2018; 28(3):341-58.
24. Perner J, Kain W, Barchfeld P. Executive control and higher-order theory of mind in children at risk of ADHD. Infant and Child Development: An International Journal of Research and Practice. 2002; 11(2):141-58.
25. Yang J, Zhou S, Yao S, Su L, McWhinnie C. The relationship between theory of mind and executive function in a sample of children from mainland China. Child psychiatry and human development. 2009; 40(2):169-82.