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Are neurocognitive abilities and social cognition related to social and role functioning in familial high risk group for psychosis?

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Abstract

Aims: In this study, we aimed to compare neurocognitive abilities and social cognitive features among adolescent offspring of psychotic individuals and healthy controls.

Methods: The study sample was composed of offspring of patients with psychotic disorders ($n = 30$), the high risk group (HR), and age and sex matched healthy controls ($n = 32$) the Control Group (CG). The psychiatric diagnoses were established by using the KD-SADS. Strengths and Difficulties Questionnaire adolescent and parent forms (SDQ-A, SDQ-P) were used. General functioning status were evaluated by The Children's Global Assessment Scale (CGAS) and Global Functioning Scale: Social and Role Functioning. Wisconsin Cart Sorting Test, Controlled Oral Word Association Test, California Verbal Learning Test, Stroop Colour and Word Test and Trail Making Tests A and B were used to assess neurocognitive abilities; to assess social cognition and empathy skills DANVA-2 and Bryant Empathy Scale were used, respectively.

Results: Among HR 53.33% had at least one psychopathology. SDQ-A, SDQ-P scores were significantly higher, and CGAS, social and role functioning scores were significantly lower in HR. Neurocognitive test scores were significantly worse except for SCWT scores in the HR. No significant differences were obtained in social cognition. A variety of the neurocognitive abilities were significantly correlated with the role functioning. In regression analyses, the most predictive scores were WCST total correct scores and role functioning score.

Conclusions: HR group showed more impairments in neurocognition, social, role and overall functioning, whereas there was no significant difference in terms of social cognition. Disturbances in neurocognition were correlated with impairments in role functioning.

KEYWORDS
family high risk, neurocognition, psychosis, social cognition

1 | INTRODUCTION

Psychotic disorders have many negative consequences in terms of personal, familial, social, and clinical aspects. In order to improve these negative outcomes, appropriate interventions are needed for the risk groups aiming to prevent the transition to psychosis (Fusar-Poli et al., 2017).

Clinical high risk/ultra-high risk classification for psychotic disorders has been established nearly for two decades, to implement possible interventions (McGlashan et al., 2010; Yung et al., 2006).

According to this classification system, individuals with first degree relatives with psychotic disorders are included in the genetic susceptibility/familial high risk group if the individual is help seeking and there has been a decrease of at least 30% in functioning (in general assessment of functioning scale) for at least previous 1 month period (McGlashan et al., 2010). On the other hand, unaffected offspring of individuals with schizophrenia spectrum disorders also carry elevated genetic risk for the illness and may manifest neurocognitive impairments (Bora et al., 2014; Seidman et al., 2006; Snitz et al., 2006). Accordingly, many studies conducted with this particular group of individuals, reported an increased risk not only for psychosis but also for any kind of psychiatric disorders (Keshavan et al., 2008; Rasic et al., 2014). During early adolescence, several possible underlying neurodevelopmental mechanisms are likely to be altered in these genetic risk group individuals; resulting in a range of psychiatric symptoms and disorders (Sanchez-Gistau et al., 2015).

A wide range of neurocognitive deficits in patients with schizophrenia and chronic psychotic disorders have also been studied in high risk groups in a substantial number of studies (Fis et al., 2008; Gur et al., 2007; Seidman et al., 2006). For example, while high risk individuals performed better in attention, verbal memory, and executive functions than first episode psychotic individuals, they had greater deficits when compared to healthy controls (Bora et al., 2014).

Recent studies reported that interventions in high risk group for psychosis may provide an opportunity to improve the outcomes. In addition to impairments in neurocognitive abilities, it has been suggested that familial high risk groups may also have social cognitive deficits similar to patients with schizophrenia (Green & Leitman, 2008; Lavoie et al., 2013). Whereas there are evident indicators about deficits in social information processing, inconsistent findings are identified related to possible impairments in empathic abilities. In a meta-analytic study, the importance of endophenotypic role of social cognition in high risk groups were highlighted (Lavoie et al., 2013). It should also be noted that among all cognitive abilities, social cognition has the most profound effect on a person's daily functioning for individuals with schizophrenia (Fett et al., 2011; Green et al., 2015).

As a result of high rates of psychopathology and impairments in neurocognitive abilities and social cognition, high-risk individuals experience difficulties in social and academic areas and their daily functioning are adversely affected (Cornblatt et al., 2011; Gibson et al., 2010). In their study, Cornblatt and her colleagues emphasized a strong link only between neurocognition and functioning, but not with social cognition and functioning. This lack of findings in terms of the association between social cognition and functioning in the literature supports the importance of the current investigation. A neurodevelopmental model might be proposed in which deterioration in social and role functioning during adolescence are the basic components for a biological susceptibility which may in turn lead to core symptoms. In that case, these malfunctioning areas might also be a possible target for the early interventions (Cornblatt et al., 2003).

In this study, we aimed to examine neurocognitive abilities and social cognitive features of adolescents with familial high risk for psychosis and compare them with those of a control group. The second aim of the study was to evaluate the global functioning, social and role functioning of the high risk group, and to determine the relationship between cognitive abilities and possible impairments in functioning.

2 | METHODS

The research was planned as a cross-sectional study. The study protocol was approved by the Marmara University Medical Faculty Ethics Committee (09.2017.040). Detailed information about the study was given to parents and adolescents who were voluntary participants in the study. Written informed consent was obtained from the healthy parent, as well as the adolescents.

2.1 | Participants

The study sample included offspring of chronic psychotic patients who were being followed up in Pendik and Tuzla Community Mental Health Centers (CMHC) in İstanbul. Parents were simply contacted as a means to aid in recruitment of at-risk adolescents. Turkish was the primary language spoken by the all participants.

Parents who were registered in CMHC due to psychotic diseases (schizophrenia spectrum and other psychotic disorders) having children between the ages of 11 and 18 years of age, were informed about the study by psychiatrists and psychologists working in these CMHCs. Parents with bipolar and related disorders were not included in the study. Those who agreed to participate in the study were referred to our outpatient clinic for the interview. A total of 20 parents, 15 of whom were followed up for schizophrenia and 5 of whom were followed up for psychotic disorder-not otherwise specified, participated in the study.

Exclusion criteria for study group were, presence of intellectual disability, any neurological disorder, psychotic disorder, and autism spectrum disorders, since those individuals might have difficulties in completing the study procedure. We had also excluded individuals with any chronic and/or severe medical illness, in order to eliminate any possible confounding effects. Additionally, offspring below age of 12 years and above 18 years were also excluded in order to provide a homogenous group.

Among 36 offspring who were referred to our outpatient clinic, 5 adolescents were excluded due to intellectual disability, 1 adolescent was excluded due to autism spectrum disorder. As a result, 30 adolescents between 11 and 18 years of age (mean 14.14 ± 2.05 years) who met the inclusion criteria constituted the familial high risk group (HR).

The control group consisted of age and sex matched adolescents who were admitted to other outpatient clinics of our hospital without any chronic disease and volunteered to participate in the study. After a semi-structured psychiatric evaluation, based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, adolescents without a psychiatric diagnosis were included in the study. The additional exclusion criteria for the control group were presence of a parent with any chronic psychiatric disorder. Thirty-two

adolescents with a mean age of 13.80 ± 2.99 years constituted the control group (CG).

2.2 | Clinical measures and assessment of psychopathology

The sociodemographic information of the adolescents was obtained by using the sociodemographic information form developed by the researcher.

The Strengths and Difficulties Questionnaire Adolescent (*SDQ-A*) *and Parent* (*SDQ-P*) *forms* were used to evaluate the behavioural characteristics of the participants (Goodman, 1997, 1999). Turkish validity and reliability study was conducted by Güvenir et al. (2004). The questionnaire is a short behavioural screening questionnaire used for examining mental well-being. The SDQ examines 25 attributes, divided between 5 scales: Emotional problems, Conduct problems, Hyperactivity and inattention, Peer relationship problems, Prosocial behaviours. In our study, we used SDQ-A total and SDQ-P total scores.

All adolescents were evaluated by *Schedule for Affective Disorders and Schizophrenia for School Aged Children Present – Lifetime Version – Turkish Version* (*K-SADS-PL-T*) for any DSM-IV Axis 1 disorder. It was adapted to Turkish by Gökler et al. (2004). In the assessment, additional diagnoses like specific learning disorder, autism spectrum disorder that could not be evaluated by K-SADS-PL were evaluated by clinical interview based on DSM-5 diagnostic criteria (APA, 2013).

The Children's Global Assessment Scale (*CGAS*) was used to assess the general functioning level of the participants (Shaffer et al., 1983). CGAS is a rating tool which gives a single score between 1 and 100, based on the clinician's assessment of a range of aspects related to a child's psychological functioning. According to scoring, children with a score of 80 or less are recommended for psychiatric follow-up, and children with a score of 60 or less are recommended for psychiatric follow-up and treatment.

Social and role functioning was assessed using *the Global Functioning: Social and Role scales* (Cornblatt et al., 2007). The Social scale assesses quantity and quality of peer and family relationships, The Role scale rates level of performance at school, work, or home. For both scales, scores range from 1 to 10, with 1 indicating extreme dysfunction and 10 indicating superior functioning. Those with a score of 7 or higher on the scale are considered as good functioning. In this study Social and Role functioning – current scores (assessment of their daily functioning status regarding the last month) were used.

2.3 | Cognitive assessment

2.3.1 | Neurocognitive assessment

In the present study, WISC-R and WAIS were applied to the HR and CG to determine estimated full-scale IQ scores (Wechsler, 2003). Estimated IQ was derived from the formula of Booker and Cyr (1986) using Vocabulary and Block Design subtests. The WISC-R scale was adapted to Turkish culture (Savaşır & Şahin, 1995).

TABLE 1 Cognitive assessment

Cognitive abilities		Test for assessment
Executive functions	Cognitive flexibility	Wisconsin Card Sorting Test
	Verbal fluency	Controlled Oral Word Association Test
	Processing speed	Trail Making Test A, B
Selective attention		Stroop Colour and Word Test
Verbal learning/Memory		California Verbal Learning Test – Child Version
Facial emotion recognition		DANVA-2
Empathy		Bryant Empathy Scale

As a representative of domains of executive functions, cognitive flexibility, verbal fluency and processing speed abilities were evaluated (Table 1). Both groups were assessed for cognitive flexibility by Wisconsin Card Sorting Test – Computerized Version (WCST) (Heaton, 1993); verbal fluency by Controlled Oral Word Association Test (COWAT) (Benton, 1968); processing speed by Trail Making Test A and B (TMT-A, TMT-B) (Lezak, 1995; Spreen & Strauss, 1998). A Turkish standardization study was carried out for a sample of children for the COWAT test by Şahin-Aközel et al. (2006). In these tests, WCST-total correct and categories completed; COWAT total Word number; TMT-A and TMT-B time completion scores were used.

Selective attention was assessed by Stroop Colour and Word Test (SCWT) (Golden, 1978; Stroop, 1935). The validity and reliability study in our country was carried out by Karakaş (Karakaş, 2004; Kılıç et al., 2002). Stroop-5-part completion period scores were used.

Verbal memory was assessed by The California Verbal Learning Test – Children's Version (CVLT-C) (Delis et al., 1994). The Turkish version was translated and used in various researches and dissertations (Kılınçaslan et al., 2011; Kora et al., 2000; Mollahasanoğlu, 2002; Yılmaz, 2014). In CVLT-C test; A list short delay recall (CVLT-C SDR), A list long delay recall (CVLT-C LDR), recognition, and discriminability scores were used.

2.4 | Assessment of social cognition

The Diagnostic Analysis of Nonverbal Accuracy-2 (DANVA-2) (Nowicki & Duke, 1994) was administered for assessment of emotion cognition ability of participants. Child and Adult Faces subtests of DANVA-2 were used to assess facial expression recognition. Each computer-administered subtest includes 24 photographs of child or adult models (12 females, 12 males per subtest) displaying equal numbers of high- and low-intensity expressions of happiness, sadness, anger, and fear. Dependent variables were total errors of 48 photographs, created separately for each emotion. Child and adult faces subtests and high- and low-intensity expressions were combined to

increase power. In our study, the total number of error scores of each emotion and the total error scores were used.

Bryant Index for Empathy (BEI) (Bryant, 1982) was used to evaluate the trait empathy. The scale adapted by Bryant is a 22-item self-assessment scale. In the scale, higher score reflects better empathic skills. It was adapted Turkish language by Yılmaz (Yılmaz-Yüksel, 2003). The Bryant Empathy scale is more of an affective empathy measure. However, empathy includes several components of cognitive and affective skills, such as sharing, understanding, and responding to emotional experiences of another person. It depends on multiple components of social cognition (Decety & Jackson, 2004; Shamay-Tsoory, 2011; Singer & Lamm, 2009). Therefore, it can be used as an example of a complex social cognitive function that integrates several social processes. It is shown to be impaired in schizophrenia and individuals at clinical high risk of psychosis (Green & Leitman, 2008; Montag et al., 2020).

2.5 | Statistical analyses

SPSS 21.0. was used to analyse the data. First, preliminary analysis of the assumptions of parametric statistics was conducted. The Kolmogorov–Smirnov test was used to check the normal distribution of the variables. Since the assumption of normality was not met, non-parametric statistical tests were used. Mann–Whitney *U* test was used for pairwise comparisons of the groups. The Spearman's rank-order correlation was conducted to determine the relationship between cognitive abilities (neurocognitive and social cognition) and social and role functioning scores. Logistic Regression Analysis (enter method) was used to determine predictive factors of HR. Neurocognitive assessment test scores (WCST scores, TMT B scores, COWAT scores, CVLT-C scores) and social and role functioning scores were the dependent variables and the groups were independent variables in the regression analyses. Since HR and control groups were age and sex matched, and in the first steps of the statistical analyses IQ scores were found to be comparable, we did not control for sex, age, IQ or education levels during logistic regression. Significance level (p) was set as <.05.

A Bonferroni correction was used for multiple comparisons in the correlation analyses of individual cognitive abilities ($\alpha = .05/24 = .002$).

3 | RESULTS

3.1 | Demographic, clinical characteristics and functioning levels

HR and CG were similar with respect to age and sex (respectively $p = .559$, $p = .806$). When compared to control group, the presence of the divorce or separation of the parents were significantly more common in the HR ($p = .046$). In HR, the number of siblings and the number of family members were significantly higher (respectively $p = .023$, $p = .012$). While mothers' educational level was lower than control group ($p = .036$) there was no difference between fathers' educational level ($p = .110$) between two groups. The level of income per person (total income level of the family/number of people living in the family) was lower in the HR ($p = .001$).

All participants in HR and CG were living in the family home and all of them currently enrolled in school. When the two groups were compared in terms of reading and writing acquisition (learning in first semester of first grade or second semester and later), it was found that the high risk group learned to read and write later, however the difference in groups failed to reach significance ($p = .052$). Preschool education status in the high risk group was significantly lower ($p = .044$). All participants were attending school and no one had an employee status. The rate of previous admissions to psychiatry was significantly higher in the HR ($p = .045$), however at the time of study no one was under psychiatric follow-up, and there was no prior history of psychiatric hospitalization. Also, none of the participants in the study groups were using alcohol or illicit drugs.

As a result of KD-SADS assessment, 53.3% ($n = 16$) of the cases in the HR were diagnosed with one or more psychiatric disorder. Thirty percent of the HR ($n = 9$) had co-morbidity. Attention-deficit/hyperactivity disorder (ADHD) 53.3% ($n = 9$) was the leading psychopathology. The other psychiatric diagnoses were social pragmatic disorder 18.75% ($n = 3$); specific learning disorder 12.25% $n = 2$; obsessive compulsive disorder (12.50%) ($n = 2$); anxiety disorders 6.25% $n = 1$; specific phobia 12.50% $n = 2$; major depression 6.25% ($n = 1$); enuresis nocturna 6.25% ($n = 1$); oppositional defiant disorder 6.25% ($n = 1$).

SDQ-A total strength and SDQ-P total strength scores were significantly higher in the HR. CGAS scores, Global Functioning: Social and Role Functioning scores were significantly different in both groups (Table 2). In HR, 60% of the adolescents were recommended

TABLE 2 SDQ-A, SDQ-P, CGAS, social and role functioning scores

Measures	HR $n = 30$	CG $n = 32$	
	$\overline{X} \pm Ss$		p
SDQ-A: Total score	13.13 ± 5.31	5.91 ± 3.68	**.001***
SDQ-P: Total score	11.33 ± 5.58	5.47 ± 3.21	**.001***
CGAS	73.17 ± 12.83	87.91 ± 6.09	**.001***
Social functioning – Current	7.97 ± 1.27	8.75 ± 0.80	**.013***
Role functioning – Current	7.13 ± 1.50	8.75 ± 1.05	**.001***

Note: $p^* < .05$ Mann–Whitney *U* test.
Abbreviations: CGAS, The Children's Global Assessment Scale; SDQ-A, SDQ-P: Strengths and Difficulties Questionnaire adolescent and parent form.

for psychiatric follow-up, and 36.6% were recommended for psychiatric follow-up and treatment.

When social and role functioning, scores were classified as good functioning (7 and above) and poor functioning (6 and under); there was no significant difference between groups in terms of social functioning scores ($p = .189$). However, 36.7% of HR had poor role functioning, while none of the individuals in CG had poor role functioning ($p = .000$).

3.2 | Cognitive assessment

There were no significant differences between HR and CG in terms of block design and vocabulary subtests standard scores and estimated IQ scores (Table 3).

Arithmetic mean, SD and *p* values of neurocognitive abilities and social cognition assessment scores between high risk and control groups are presented in Table 3. Significant differences were found for the scores of neurocognitive tests – WCST total correct number, WCST categories completed, COWAT total Word number, TMT-A, TMT-B time completion, CVLT-C discriminability scores. No significant differences were obtained in SCWT scores.

During the assessment of social cognition, there was a significant difference only in "DANVA-2 child faces – happy" error score between the two groups. As far as the empathy assessment scale was concerned, HR had lower scores than the CG, however the difference between groups did not reach statistical significance.

Spearman rank order correlation analysis was used to determine the relationship between the social and role functioning scores and other test results in the HR and CG. The results obtained from the analysis were given in Table 4.

3.3 | Results of regression analysis in high risk and control groups

The best predictors of the difference between the two groups were WCST score those measures cognitive flexibility among

TABLE 3 Neurocognitive and social cognition assessment

Scores	HR $n = 30$	CG $n = 32$	
	$\overline{X} \pm Ss$		*p*
Estimated IQ	100.40 ± 17.55	109.09 ± 17.61	.052
Block design (raw score)	9.87 ± 3.60	11.34 ± 3.23	.071
Vocabulary (raw score)	10.53 ± 2.53	11.16 ± 2.49	.069
WCST3: Total correct	75.97 ± 21.86	93.84 ± 13.74	**.001***
WCST4: Categories completed	3.97 ± 2.43	5.94 ± 2.27	**.002***
COWAT: Total word number	30.40 ± 13.30	38.72 ± 10.31	**.009***
TMT-A: Total duration	38.80 ± 15.41	29.89 ± 11.64	**.014***
TMT-B: Total duration	100.28 ± 42.72	29.89 ± 11.64	**.004***
SCWT-5: Total duration	27.46 ± 11.28	24.23 ± 7.21	.125
CVLT-C Discriminality	93.73 ± 7.86	97.43 ± 3.25	**.048***
CVLT-C SDR	9.40 ± 2.75	10.25 ± 2.59	.259
CVLT-C LDR	9.83 ± 2.49	10.72 ± 2.84	.187
CVLT-C Recognition	13.37 ± 2.28	14.13 ± 1.16	.129
DANVA-2 Child – Happy error score	0.73 ± 0.87	0.28 ± 0.77	**.008***
DANVA-2 Child – Sad error score	0.59 ± 0.95	0.53 ± 0.78	.954
DANVA-2 Child – Anger error score	3.23 ± 1.55	2.53 ± 1.27	.88
DANVA-2 Child – Fear error score	0.97 ± 1.30	0.69 ± 0.78	.691
DANVA-2 Child: Total error	5.52 ± 3.07	4.03 ± 2.39	.058
DANVA-2 Adult – Happy error score	0.57 ± 0.63	0.34 ± 0.70	.063
DANVA-2 Adult – Sad error score	1.30 ± 1.37	1.22 ± 0.91	.819
DANVA-2 Adult – Anger error score	2.20 ± 1.13	1.72 ± 0.96	.142
DANVA-2 Adult – Fear error score	1.93 ± 1.43	1.47 ± 1.14	.247
DANVA-2 Adult: Total error	6.00 ± 2.32	4.75 ± 2.01	.107
Empathy	11.57 ± 2.75	12.31 ± 3.04	.236

Note: *$p < .05$ Mann–Whitney *U* test.
Abbreviations: COWAT, Controlled Oral Word Association Test; CVLT-C, California Verbal Learning Test – Child Version; LDR, long delay recall; SCWT, Stroop Colour and Word Test; SDR, short delay recall; TMT-A,B, Trail Making Test A, B; WCST, Wisconsin Card Sorting Test.

neurocognitive tests and role functioning among measures of functioning. Poorer WCST performance and role functioning was associated with a higher likelihood of being in HR group (Table 5).

4 | DISCUSSION

In our study, we examined psychopathology, neurocognitive abilities, social cognition and functioning status of adolescents with familial high risk for psychosis and the results were compared with age and sex-matched healthy adolescents.

When the educational levels, family profiles, and income levels of the two groups were compared, the high risk group families had a lower socioeconomic status and the divorce rates were higher. These factors can be classified as important environmental factors and when they are added to genetic risk factors in HR, they may increase the risk of transition the psychosis (Dean & Murray, 2005).

In the high risk group, as a result of DSM-5 and KD-SADS based interviews, psychopathology rate was as high as 53.66%. When we examined the type of psychopathologies, attention deficit and hyperactivity disorder (ADHD) was the most frequent (56.25%) disorder. High rates of ADHD among psychiatric disorders, can be conceptualized due to its neurodevelopmental basis (Duffy, 2012). On the other hand, there are also studies suggesting that ADHD and psychotic disorders may be sharing a common genetic pool (Larsson et al., 2013).

In our study, the Strength and Difficulties Questionnaire (SDQ) was used to investigate the behavioural characteristics. Similar difficulties reported both by the parents and the adolescents, themselves, reflected the power of the findings in terms of consistency (González-Pinto et al., 2011; Noguera et al., 2018). These reported difficulties in several areas enabled us to get information about the difficulties experienced by the adolescents even if psychopathology has not yet developed. Early interventions addressing the reported difficulties are important to increase the resilience for possible future psychiatric disorders in these high risk individuals.

According to CGAS scores which evaluate general functioning, HR had a significantly lower score. In HR, 60% of adolescents were in the range of "requires psychiatric follow-up". This high rate once again emphasizes on the high risk individuals' need for psychiatric follow-up within the scope of prevention even if there is no clinical referral.

The high risk group had statistically significant lower scores in social functioning and in role functioning reflecting problems in interpersonal relationships and in performance in school/work/home life, respectively. According to previous research, while the deterioration in social functioning remained stable even during the transition to psychosis and that it was not affected by exacerbation of the disorder, role functioning was more influenced by environmental factors such as hospitalizations, comorbid depression, and pharmacotherapy (Cornblatt et al., 2011; Meyer, 2014). On the other hand, since our study was cross-sectional in nature, these scores will be more promising during the long term follow up of these high risk individuals for the evaluation and interpretation of their everyday functioning.

4.1 | Cognitive assessment

Consistent with previous studies (Erlenmeyer-Kimling et al., 2000; Keshavan et al., 2010; Seidman et al., 2006), the high risk group scored worse in the WCST test scores, indicating less cognitive

TABLE 4 Correlation analysis between the social and role functioning scores and other test results in the HR and CG

		HR $n = 30$		CG $n = 32$	
		Social functioning score	Role functioning score	Social functioning score	Role functioning score
Block design	r_s	.090	.500**	.319*	.522**
Vocabulary	r_s	.059	.510***	.150	.373**
WCST3: Total correct number	r_s	.024	.439*	.071	.413**
Stroop-5: Total duration	r_s	.199	.081	.007	−.166
COWAT: Total word number	r_s	.215	.348	.117	.440**
TMT-A: Total duration	r_s	−.352	−.336	−.212*	−.261*
TMT-B: Total duration	r_s	−.120	−.169	−.323*	−.323*
CVLT-C SDR	r_s	.219	.498***	.147	.387**
CVLT-C LDR	r_s	.381*	.406*	.206	.383**
DANVA-child: Total error	r_s	−.042	−.209	−.150	−.218
DANVA-adult: Total error	r_s	−.213	−.356	−.303	−.180
Empathy	r_s	.178	.228	.323	.215

Abbreviations: COWAT, Controlled Oral Word Association Test; CVLT-C, California Verbal Learning Test—Child Version; LDR, long delay recall; SCWT, Stroop Colour and Word Test; SDR, short delay recall; TMT-A,B, Trail Making Test A, B; WCST, Wisconsin Card Sorting Test.

*Spearman correlation analysis: Correlation is significant at the .05 level (one tailed);

**Correlation is significant at the .01 level (one tailed);

***Correlation is significant at the .001 level (one tailed).

TABLE 5 Regression analysis in HR and CG

Neurocognitive variables	*B*	*SE*	Wald	*df*	Sig	Exp (*B*)
WCST total correct number	0.039	0.020	3.940	1	**.047***	1.040
TMT-B duration	−0.018	0.010	3.325	1	.068	0.982
COWAT total	0.012	0.030	0.168	1	.062	1.012
CVLT-C discriminality	0.076	0.060	1.578	1	.209	1.079
Social and Role Functioning Scores						
Social Functioning Score	0.312	0.359	0.754	1	.385	1.336
Role Functioning Score	0.837	0.268	9.720	1	**.002***	2.309

Abbreviations: COWAT, Controlled Oral Word Association Test; CVLT-C, California Verbal Learning Test—Child Version; LDR, long delay recall; SDR, short delay recall; TMT-A,B, Trail Making Test A, B; WCST, Wisconsin Card Sorting Test.
*$p < .05$ logistic regression analysis.

flexibility; in trail making test duration scores, indicating lower processing speed; and in COWAT total Word number scores, indicating decrease in verbal fluency. Surprisingly, in Stroop subtest 5 evaluating response inhibition against disruptive effect there were no significant differences between the two groups. In fact, since ADHD rates were high in the HR, one could expect that there would be a difference in the attentive functions of the groups. The reason for this unexpected result was not clear, however by using Stroop we might have inadequately evaluated the attention function. On the other hand, there were contradictory results in previous studies. For example, while in a recent meta-analysis by Bora et al. (2014), a similar finding was reported where no distinction was observed between the UHR group and healthy controls in the disturbing effect of the Stroop test, many other studies reported deficiencies in attention in high risk individuals (Cornblatt et al., 2001; Chen et al., 2000; Agnew-Blais & Seidman, 2013). Although HR had lower scores in all subtests of CVLT-C, assessing verbal learning and memory abilities, the difference was statistically significant only in the measurement of discriminality. Although verbal learning/memory ability is a frequently detected neurocognitive endophenotype with a large effect size in both familial risk groups and clinical risk groups, in our study we can assume that some deficiencies in verbal memory are perhaps at the beginning stage, and that we can show possible impairments more clearly with longitudinal follow-up (Bora et al., 2014; Keshavan et al., 2010; Sponheim et al., 2004). To sum up, as neurocognitive domains cognitive flexibility, verbal fluency, processing speed, and verbal learning deficiencies, which could be regarded as endophenotypes (Gottesman & Gould, 2003), were similarly demonstrated in our study. Our results may offer additional support for other studies on the genetic transmission of cognitive impairment in high-risk individuals (Bortolato et al., 2015).

The other possible endophenotype in question was the social cognition abilities, where trait empathy and emotion recognition skills of the participants were evaluated. Although HR had lower scores on the scale (BEI) measuring trait empathy, the difference was not statistically significant. To our knowledge, this is the first study to examine empathy in adolescent offspring of patients with psychotic disorders. In many of the studies, impairments in empathy have been reported in schizophrenia patients (Montag et al., 2007); in which affective empathy was found to be relatively preserved, while there were lower self-ratings for cognitive empathy. There were also previous studies with contrasting results regarding empathy skills of high risk individuals. For example, Montag et al. (2012) reported that first-degree relatives of schizophrenia patients had subtle deficits in cognitive component where as they were comparable with control group in terms of affective empathy skills. In another, more recent study, significant reductions of emotional empathy were demonstrated in individuals at clinical high risk of psychosis, while cognitive empathy appeared intact (Montag et al., 2020). However, empathy has not been evaluated as a stand-alone parameter in most studies evaluating social cognition in at-risk groups. For the future research, we believe that a more comprehensive evaluation of both the affective and cognitive elements of empathy will help us better understand the possible differences in empathic skills among these young people.

In the emotion recognition test, although HR had worse results in all domains, a significant difference was only shown in the child-happy facial expression domain score. We can speculate that with a larger study group, the significant difference could be more clearly demonstrated in all emotion types. Studies conducted in unaffected first-degree relatives of schizophrenia patients showed inconsistent results regarding social cognition. Some studies have shown that there were deficiencies in social cognition, while others have indicated no difference (Bediou et al., 2007; Alfimova et al., 2009; Kelemen et al., 2004; Loughland et al., 2004). For example, consistent with our study, Barkl and colleagues reported that first-episode psychosis patients had impairments in the recognition of happy facial expression besides disgust, fear, surprise, and sadness (Barkl et al., 2014). In a 2015 study by Allott et al., first-degree relatives of first-episode schizophrenia patients had worse results in recognizing fearful facial expressions, whereas in a familial high risk study, the individuals were reported to perceive especially neutral emotions negatively (Eack et al., 2009). Social cognition may also be more related to state factors or worsening of the illness (Green et al., 2015). As a result, rather than assessing individual abilities to understand possible deficiencies in social cognition, a comprehensive and dimensional approach is needed to assess all the abilities covered by social cognition. Thereby several social cognitive subprocesses such as face perception, mentalizing, emotion regulation, and empathy could be discriminated and their associations

with genetic or environmental factors could be highlighted (Green et al., 2015).

As for the relation between the functioning and the cognitive tests we found out that the role functioning was directly related with the adolescents' intelligence scores, executive functions, verbal fluency, processing speed, and verbal learning skills. On the other hand, higher social functioning level was only found to be correlated with high verbal learning skills. However, there was no significant relationship between performance on the social cognitive measures and social and role functioning. Previous studies indicated that general functioning was an important key feature to monitor because during the prepsychotic period along with neurocognitive deficiencies general functioning has been shown to deteriorate in high risk individuals (Carrión et al., 2011; Gkintoni et al., 2017).

As a result of regression analysis conducted with neurocognitive tests, in HR we found that cognitive flexibility had the highest predictive value among other cognitive abilities. This finding was partially in line with a previous study, which reported that visual memory, response inhibition, and, cognitive flexibility could have predictive value for the familial risk group (Gkintoni et al., 2017). In terms of functioning, role functioning score had a better predictive value than the social functioning. In some of the earlier studies, while social functioning was reported to predict the risk of transition to psychosis in individuals at risk, it was stressed on that role functioning could be used as an indicator to determine the response to environmental changes and treatment in order to monitor the clinical presentation during the course of the disorder (Cornblatt et al., 2011).

4.2 | Limitations

There are two distinct limitations of this study. The first limitation was the small sample size therefore, our results cannot be generalized. Additionally, possibly due to small sample size the difference in the Stroop test scores failed to reach significance level, even though the HR group had longer duration scores than the control group. Given that the low rates of marriage among adults with schizophrenia or chronic psychotic disorders, and other factors like unwillingness of some of the offspring, or loss of contact of the parents with their offspring, we were unable to gather a fairly larger sample size. The second limitation was that The Bryant Empathy scale is more of an affective empathy measure. However, in order to have more comprehensive results, both affective and cognitive dimensions of empathy must be taken into account in forthcoming studies.

5 | CONCLUSIONS

When compared to controls, adolescents with familial high risk for psychosis had significantly more impairment in neurocognitive abilities such as cognitive flexibility, verbal fluency, processing speed, and verbal learning. They significantly showed more impairment in social and role functioning. Additionally, disturbances of neurocognitive abilities were correlated with impairments in role functioning. These findings, may be suggestive of cognitive flexibility and role functioning to serve in the identification and the long term follow up of individuals in high risk group, thereby increasing the possibility to monitor their general functioning and implement necessary interventions when needed.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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