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Predisposing Variables in Children with Risk of Disruptive Mood: A Clinical Case–Control Study

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ABSTRACT

Disruptive mood dysregulation disorder (DMDD) is defined in the DSM-V as frequent, severe temper outbursts that significantly impair functioning in different environments. This was a second-stage of follow-up study, conducted to screen the frequency of DMDD in an elementary school. In the first-stage of our study, 453 children between ages 7–11 were evaluated in terms of DMDD high-risk with Children Behavior Check List (CBCL). Of the children, 30 high-risk and 30 low-risk children for DMDD according to CBCL agreed to participate this clinical case–control study. Diagnoses of anxiety disorder, attention deficit and hyperactivity disorder (ADHD), and oppositional defiant disorder were more common among children in the high-risk group than the control group. Symptom Checklist-90-Revised (SCL-90-R) mothers' interpersonal, anger, and paranoid subscale scores were higher in the DMDD high-risk group than the control group. Children in the DMDD high-risk group scored higher than the control group in all SRS subscales. In the Diagnostic Analysis of Nonverbal Accuracy (DANVA) test, the DMDD high-risk group had higher error rates for fearful and intense facial expressions. Multiple linear regression analysis showed that having a diagnosis of ADHD, high maternal SCL-90-R anger score, and presence of a paternal psychiatric diagnosis increased the high-risk of DMDD.

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Introduction

Irritability can be defined as an increased tendency to anger compared to their peers at the same developmental level (Brotman et al. 2017). Irritability has both cross-sectional and longitudinal association with many psychopathologies, especially bipolar disorder (BD), major depressive disorder (MDD), attention deficit hyperactivity disorder (ADHD), conduct disorder, anxiety disorders, and autism (Argyris et al. 2018). In recent years, a new developmental pattern in which irritability and oppositional behaviors are observed together has been described in school-age children (APA 2013). Disruptive mood dysregulation disorder (DMDD), which is considered more closely associated with MDD instead of BD, is characterized by temper outbursts that cause significant functional impairment in different settings (Propper et al. 2017).

In some of the irritability focused disorders – autism, BD, and ADHD – facial emotional recognition skills, and social responsiveness are affected (Ayaz, Ayaz, and Yazgan 2013). However, there has been little research in DMDD investigating the effect of irritability on social skills, or its underlying causes. Children and adolescents diagnosed with DMDD have been shown to have poor ability to read emotions from facial expressions (Argyris et al. 2018), to perceive neutral faces as threatening (Hommer et al. 2014; Salum et al. 2017), and to focus their attention on angry faces more than the control group (Brotman et al. 2010; Stoddard et al.

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2016). Adolescents diagnosed with DMDD frequently have comorbid psychopathologies such as ADHD, oppositional defiant disorder, conduct disorder, anxiety disorder, and MDD (Antonio et al. 2019; Argyris et al. 2018) and genetic factors as well as environmental factors are believed to have various roles in the development of DMDD. However, there are few studies about the prevalence and types of psychopathologies in the families of DMDD-diagnosed children. A recent study showed that the children of patients diagnosed with MDD had a higher rate of BD and DMDD compared to the control group (Propper et al. 2017). Moreover, the prevalence of DMDD among the children of patients diagnosed with BD is not clear (Perich et al. 2017; Sparks et al. 2014).

As DMDD is a new diagnostic category, few studies have been conducted in this patient group in our country. To the best of our knowledge, the comorbid psychopathologies and patterns of social interaction of DMDD children have not yet been characterized. Therefore, in the present study, we aimed to evaluate psychopathology and social skills in children with high risk of DMDD. We hypothesize that children with a high risk of DMDD will show impaired social responsiveness and facial emotional recognition skills compared to those with low-risk group. We also aimed to identify the predictors of DMDD risk in children aged 7–10.

Methods

This was a second stage of a follow-up study conducted to screen the frequency of DMDD in an elementary school in the Pendik district of the Istanbul province (Tüğen, Göksu, and Burcu Ayaz 2020). In the first stage of our study, the Child Behavior Checklist (CBCL) was filled by the parents of all students in grades 1 through 4 of an elementary school ($n = 453$). Of these, 93 children with a total score of 180 and higher on the CBCL attention, anxious/depression, and aggression subscale scores were considered to be at high risk for DMDD, and children with scores lower than 180 were considered to be a low-risk group for DMDD ($n = 360$). The second stage of the study was conducted by the Department of Child and Adolescent Psychiatry of Marmara School of Medicine between February and June 2018. The study protocol was approved by the Institutional Review Board (protocol/serial number: 09.2020.975). All of the study procedures were carried out in accordance with the Declaration of Helsinki and local laws and regulations. Parental informed consent and the verbal consent of the children were obtained prior to study inclusion. The authors received no specific funding for this research. The exclusion criteria for the high-risk group were: mental retardation, autism spectrum disorders, psychosis, chronic, or severe medical conditions, and such neurological diseases as seizure. Due to the limited number of cases, comorbid psychiatric disorders other than those mentioned above were not considered exclusionary for the high-risk group. None of the children in the low-risk group had a previous psychiatric diagnosis.

Sampling and study flow

In the second stage of the study, which is the subject of this article, CBCL parent report forms received from the school were reviewed by two child and adolescent psychiatrist. Children in the DMDD high-risk group ($n = 93$) were called by phone and in the pre-interview conducted by phone the purpose and method of the study were explained comprehensively. Parents and children between the ages of 7–10, who accepted to participate in the study ($n = 54$) were invited to the study center for further assessment. Among the invited children, 9 children were excluded from the study due to exclusion criteria, 11 children due to cancellation of the appointment, and 4 children because they could not complete the tests. Thirty children who completed the clinical assessment, formed the high-risk group of the study. A protocol similar to the high-risk group was applied for the low-risk group. Out of 360 low-risk children, starting from those with the lowest score on the CBCL-Dysregulation Profile were called by phone. Of the invited children, 30 low-risk children with similar age and gender to the high-risk group constituted the study group of the second stage.

Measures

A sociodemographic information form, the Social Responsiveness Scale (SRS), Affective Reactivity Index (ARI) parent form, and Symptom Checklist-90-Revised (SCL-90-R) were completed by the mothers, and the children completed the ARI self-report form and Diagnostic Analysis of Nonverbal Accuracy (DANVA) test. The children's psychiatric diagnoses were evaluated by two child and adolescent psychiatrists according to the DSM-V.

Sociodemographic information form

Parental ages and education levels, family income level, family psychiatric history, and developmental milestones were questioned on the sociodemographic information form. The mothers signed an informed consent statement at the beginning of the form.

Child Behavior Checklist-Dysregulation Profile (CBCL-DP)

The CBCL parent report form is a, 3-point, likert-type scale which evaluates the functionality and problematic behaviors of children aged 4–18. In the CBCL, a cutoff point of 60 is used for subscale scores and 65 for internalizing, externalizing, and total scores (Achenbach and Edelbrock 1983). The Turkish version was found to have adequate reliability and validity (Erol, Arksan, and Akçakın 1995). The CBCL-dysregulation profile includes the subscales of attention problems (5 items, Cronbach's alpha = 0.63), anxiety/depression (8 items, Cronbach's alpha = 0.70), and aggressive behaviors (19 items, Cronbach's alpha = 0.90). Elevations in those subscales are assumed to denote emotional dysregulation (Boomsma et al. 2006; Mbekou et al. 2014). In previous studies, T score of >210 was defined as clinically significant emotional dysregulation, a T score of between 180 and 210 was defined as an emotional self-regulation deficiency, T score ‘180 was defined as no emotional regulation difficulties (Kutlu, Akyol Ardic, and Sabri Ercan 2017). In this study, a score of 180 and above was classified as the high-risk group which reflect clinically significant emotional dysregulation, and scores below 180 as the low-risk group for DMDD (Biederman et al. 2012; Mbekou et al. 2014).

Social Responsiveness Scale (SRS)

SRS, which was developed by Constantino in 2000, evaluates autism-like symptom clusters and has been shown to have high reliability and validity and completed by parents (Constantino et al. 2000, 2003). The scale includes a total of 65 items: 39 items targeting reciprocal social behavior, 6 items on social use of language, and 20 items on autistic traits. A higher score corresponds to more severe social impairment. Although the reliability and validity of the Turkish version have not been reported it was used in a large-scale study on school-age children by Ünal et al. The internal consistency (Cronbach's alpha) was calculated as 0.86 and its reliability was found to be high (Pearson's $r = 0.53$, $p < 0.001$) (Ünal et al. 2009).

Symptom Checklist-90-Revised (SCL-90-R)

The SCL-90-R is a screening tool used for self-assessment of psychological symptoms. Derogatis developed the list at the Psychometric Research Unit of John Hopkins University using the inventory known as the Hopkins Symptom Checklist (Derogatis and Cleary 1977). The scale is a Likert-type scale consisting of 90 items in 10 symptom groups: somatization, obsessive-compulsive, anxiety, anger, and hostility, interpersonal sensitivity, depression, phobic anxiety, paranoid thoughts, psychoticism, and additional items. Each item is rated on a 5-point Likert scale ranging from "'Not at all'" (0) to "'Extremely'" (4). A global score is calculated by dividing the total score obtained in all items by the total number of items. The Turkish validity and reliability study of the scale was conducted by Dağ (Dağ 1991).

Clinical interview according to the DSM-V

The children were interviewed in order to determine mental diagnoses according to DSM-V criteria (APA 2013).

Affective Reactivity Index (ARI)

The ARI, which evaluates irritability in children and adolescents, consists of six symptom items and one impairment item (Argyris et al. 2012). Participants rate each statement on a Likert-type scale as not true (0 points), somewhat true (1 point), or certainly true (2 points). The total score is obtained by adding the scores of the first six items on the scale and ranges from 0 to 12 points, with higher scores indicating more severe irritability. The ARI focuses on three dimensions of irritability during the last 6 months: the threshold for anger reaction, frequency of anger feelings and behaviors, and duration of anger feelings and behaviors. Self-report and parent forms are available. The Turkish validity and reliability study of the ARI was conducted by Kocael (Kocael 2015).

Diagnostic Analysis of Nonverbal Accuracy (DANVA)

The Children's Facial Expressions subtest of the DANVA is used to evaluate ability to recognize emotional facial expressions (Nowicki and Duke 1994). This computer-based test consists of 24 photographs of child models (12 female, 12 male per subtest) showing equal numbers of high- and low-intensity expressions of happiness, sadness, anger, and fear. After viewing each photo for 2 s, the participant is asked to indicate which emotion is being expressed. The test has been validated and has acceptable internal consistency and reliability (Nowicki and Duke 1994). The dependent variable was total errors (misidentified emotions), created separately for each subtest and each emotion. High- and low-intensity expressions were combined to increase power.

Statistical analysis

The data were analyzed using the IBM SPSS Statistics for Windows version 20.0 (IBM Corp, Armonk, NY). Distribution was evaluated with the Shapiro–Wilk test. Chi-square (χ^2) test was used to compare numerical data and Student's t-test to compare continuous data. After eliminating the effect of the ARI parent form total score in the SRS and DANVA using analysis of covariance (ANCOVA), the difference between groups was evaluated. Linear regression analysis was performed to examine the factors predicting DMDD risk. When selecting the dependent and independent variables for linear regression analysis, the following statistical features were considered: A linear relationship of the variables using correlation analysis was executed. Variables that are significantly related with the continuous dependent variable but not with each other were chosen. Besides, homogeneity of the variance of the dependent variable is essential for reliable regression analysis results. Tests of homogeneity of variances were applied to ensure that the variance was homogeneous. Variables that met these conditions were set in the regression analysis. The significance level was accepted as $p < 0.05$ for all analyses.

Results

A total of 60 children participated in our study, 30 in the high-risk group and 30 in the low-risk group. Fifty percent of the high-risk group and 60% of the low-risk group were female. The high-risk group was younger, their fathers had more psychiatric diagnoses, and their family income level was lower than the low-risk group. High-school education was more common as maternal and paternal education level in the low-risk group, but the difference between the groups was not statistically significant. Psychiatric diagnoses of the fathers in the high-risk

Table 1. Sociodemographic characteristics of the participants.

	DMDD High-Risk Group ($n = 30$)	DMDD LRG ($n = 30$)	Statistical Analysis
			P*
Gender (female)	15 (50%)	18 (60%)	$\chi^2 = 0.606$. $P = 0.436$
Maternal Level of Education			
Illiterate	1 (3.3%)	1 (3.3%)	$\chi^2 = 8.564$ $P = 0.073$
Primary school	20 (66.7%)	12 (40.0%)	
Middle school	5 (16.7%)	5 (16.7%)	
High School	2 (6.7%)	11 (36.7%)	
University	2 (6.7%)	1 (3.3%)	
Paternal Level of Education			
Illiterate	0 (0%)	0 (0%)	$\chi^2 = 7.479$ $P = 0.058$
Primary school	0 (0%)	0 (0%)	
Middle school	15 (50.0%)	6 (20.0%)	
High School	5 (16.7%)	13 (43.3%)	
University	3 (10.0%)	3 (10.0%)	
Maternal psychiatric history	8 (26.7%)	4 (13.3%)	$\chi^2 = 1.667$ $P = 0.197$
Paternal psychiatric history	6 (20.0%)	0 (0%)	**$\chi 2 = 6.667$ $P = 0.010$**
Sibling psychiatric history	5 (16.7%)	1 (3.3%)	$\chi^2 = 2.963$ $P = 0.085$
Late learning to read and write	7 (23.3%)	1 (3.3%)	$\chi^2 = 5.192$ $P = 0.069$
	mean ± SD	**mean ± SD**	**P****
Age	8.88 ± 1.00	9.57 ± 0.96	**$t = -2.717$ $P = 0.009$**
Maternal age	34.97 ± 7.06	35.30 ± 7.05	$t = -0.183$ $P = 0.856$
Paternal age	41.20 ± 5.56	39.48 ± 3.88	$t = -1.370$ $P = 0.176$
Socioconomical Status			**P*****
Low	5 (71.4%)	2 (28.6%)	**P = 0.025**
Medium	22 (53.7%)	19 (46.3%)	
High	3 (25.0%)	9 (75.0%)	

Note: *P* values were calculated using the independent samples t-test and chi-square test. Bold text represents statistically significant differences.
*p is calculated by Chi-square.
**p is calculated by Student's t-test.
***p is calculated by Somers'd method.

group are; ADHD and conduct disorder ($n = 1$), depression ($n = 1$), depression and anxiety disorder ($n = 1$), obsessive-compulsive disorder ($n = 1$), panic attack ($n = 1$), and panic attack and anxiety disorder ($n = 1$). The sociodemographic data of the groups are summarized in Table 1.

As for developmental steps, high- and low-risk groups spoke their first words at respectively mean 12.07 ± 4.64 and 9.87 ± 2.76 months, first sentences at 19.00 ± 6.73 and 18.93 ± 5.55 months, walked at 11.69 ± 2.49 and 12.67 ± 2.33 months, and completed toilet training at 26.00 ± 8.40 and 29.00 ± 6.70 months. In the developmental steps of first word ($t = 2.222$, $p = 0.030$), there was statistically significant difference between high- and low-risk groups. Evaluation of developmental milestones revealed no difference in terms of first sentence ($t = 0.042$, $p = 0.967$), walking ($t = -1.552$, $p = 0.126$) and toilet training ($t = -1.519$, $p = 0.134$).

At least one psychiatric diagnosis was identified in 76.7% ($n = 23$) of the children in the high-risk group and 36.7% ($n = 11$) of those in the low-risk group ($\chi^2 = 9.774$, $p = 0.002$). Diagnoses of separation anxiety disorder ($\chi^2 = 5.455$, $p = 0.020$), social anxiety disorder ($\chi^2 = 5.455$, $p = 0.020$), ADHD ($\chi^2 = 7.680$, $p = 0.006$), oppositional defiant disorder ($\chi^2 = 4.286$, $p = 0.038$), and DMDD ($\chi^2 = 4.286$, $p = 0.038$) were more frequent in the high-risk group. Four children in the high-risk group were diagnosed as having DMDD in psychiatric evaluation, while no child in the low-risk group was diagnosed with DMDD.

The SCL-90 interpersonal, anger and hostility, and paranoid thoughts subscale scores of the mothers in the high-risk group were significantly higher than those in the low-risk group (Table 2). The children in the high-risk group had higher scores in the SRS social reciprocity

Table 2. Comparison of SCL-90-R scores between groups.

	DMDD High- Risk Group ($n = 30$) Mean ± SD	DMDD LRG ($n = 30$) Mean ± SD	Statistical Analysis
SCL Somatization	.66 ± .54	0.78 ± 0.64	t = −0.766. $P = 0.447$
SCL Obsessive/compulsive	.92 ± .62	0.72 ± 0.49	t = 1.332. $P = 0.188$
SCL Interpersonal	1.06 ± .74	0.70 ± 0.59	**t = 2.040. $P = 0.046$**
SCL Depression	.86 ±.60	0.66 ± 0.53	t = 1.311. $P = 0.196$
SCL Anxiety	.61 ± .52	0.46 ± 0.44	t = 1.173. $P = 0.246$
SCL Anger and Hostility	.70 ± .67	0.34 ± 0.44	**t = 2.376. $P = 0.022$**
SCL Phobic	.38 ± .43	0.39 ± 0.68	t = −0.097. $P = 0.923$
SCL Paranoid	.86 ± .63	0.56 ± 0.41	**t = 2.122. $P = 0.040$**
SCL Psychotic	.38 ± .48	0.31 ± 0.39	t = 0.660. $P = 0.512$
SCL Additional Items	.55 ± .61	0.65 ± 0.55	t = −0.608. $P = 0.546$

Note: *P* values were calculated using the independent samples t-test. Bold text represents statistically significant differences.

Table 3. Comparison of DANVA children's facial emotional recognition error rates between groups.

	DMDD HRG ($n = 30$) Mean ± SD	DMDD LRG ($n = 30$) Mean ± SD	Statistical Analysis
Happy errors	0.36 ± 0.62	0.37 ± 0.62	t = −0.135. $P = 0.893$
Sad errors	0.46 ± 0.69	0.66 ± 0.86	t = −0.923. $P = 0.360$
Angry errors	3.93 ± 1.78	3.59 ± 1.32	t = 0.825. $P = 0.413$
Fearful errors	0.86 ± 0.60	0.66 ± 0.53	**t = 2.526. $P = 0.017$**
Child errors high	2.25 ± 1.55	1.48 ± 0.95	**t = 2.258. $P = 0.028$**
Child errors low	3.39 ± 1.52	3.14 ± 1.25	t = 0.693. $P = 0.491$

Note: *P* values were calculated using the independent samples t-test. Bold text represents statistically significant differences.

subscale ($t = 3.774$, $p = 0.001$), SRS communication subscale ($t = 3.561$, $p = 0.001$), SRS motor stereotypes subscale ($t = 3.431$, $p = 0.002$), and SRS total score ($t = 4.019$, p‹ 0.001) than the low-risk group. In the DANVA children's facial expression subtest, the DMDD risk group was found to make more errors in the recognition of fearful and intense facial expressions (Table 3).

The high-risk group had higher ARI total scores than the low-risk group for both the parent form ($t = 2.969$, $p = 0.005$) and self-report form ($t = 2.734$, $p = 0.010$). After controlling for ARI parent form score, analysis of SRS scores showed that the high-risk group had significantly higher total score (mean: 59.43, 95% CI: 49.95–68.90) than the low-risk group (mean: 42.27, 95% CI: 34.50–50.03) (F [1,36] = 7.36, $P = 0.010$). Moreover, the high-risk group had significantly higher SRS scores for social reciprocity (mean [95% CI]: 45.89 [39.05–52.72] vs. 34.91 [29.44–40.38], F[1,37] = 5.59, $p = 0.020$), communication (mean [95% CI]: 4.67 [3.60–5.76] vs. 2.76 [1.80–3.72]; F[1,47] = 6.60, $p = 0.013$), and motor stereotypes (mean [95% CI]: 7.91 [5.87–9.94] vs. 4.68 [2.97–6.40]; F[1,42] = 5.50, $p = 0.024$).

After controlling for the effect of ARI parent form score, the difference in DANVA children's facial expression error scores for fearful expressions between the high-risk group (mean: 0.73, 95% CI: 0.24–1.21) and low-risk group (mean: 1.19, 95% CI: −0.25–0.63) lost significance (F [1,50] = 2.44, $p = 0.125$). The same was observed for intense facial expression error scores (mean [95% CI]: 2.16 [1.60–2.72] in the high-risk group vs. 1.52 [1.02–2.03] in the low-risk group; F [1,50] = 2.64, $p = 0.110$) (ANCOVA).

Variables affecting CBCL Dysregulation Profile score were evaluated in multiple linear regression analysis including child age, family income level, presence of ADHD diagnosis, maternal SCL anger and hostility score, and presence of paternal psychiatric history. Having an ADHD diagnosis ($p = 0.003$), higher maternal SCL anger and hostility score ($p = 0.015$), and presence of paternal psychiatric history ($p = 0.048$) were found to significantly increase the child's CBCL Dysregulation Profile score. The model explained 39.5% of the variance in CBCL Dysregulation Profile score (Table 4).

Table 4. Regression model showing the variables affecting children's DMDD panel score.

	Non-standardized coefficients		Standardized coefficients			
Independent variables	Beta	Standard error	Beta	P	95% CI	T
(constant)	251.372	30.316		**0.000**	190.449. 312.294	8.292
Age	−3.163	2.779	−0.140	0.261	−8.748. 2.423	−1.138
Family level of income	−0.004	0.003	−0.176	0.141	−0.011. 0.002	−1.498
ADHD diagnosis	−21.880	7.061	−0.350	**0.003**	−36.069.−7.691	−3.099
SCL-90 anger and hostility	11.760	4.672	0.292	**0.015**	2.371. 21.149	2.517
Paternal psychiatric history	17.962	8.868	0.231	**0.048**	0.140. 35.783	2.025
$R = 0.629$ $R^2 = 0.395$ F (5.49) = 6.408 P < 0.001						

Note: Bold text represents statistically significant differences.

Discussion

This case–control study aimed to evaluate psychopathology, social responsiveness, and emotional facial expression recognition in children with high risk of DMDD and determine the predictors of DMDD.

Impairments in distinguishing emotions from facial expressions in daily life, which may cause difficulties in emotion regulation and, as a result, in anger control, was evaluated with DANVA children's facial expression subtest, while SRS was used to evaluate the skills on how appropriate responses can be given to perceived emotions. Diagnosis of DMDD was assessed both categorically (via DSM-V) and dimensionally (via CBCL and ARI). As a result, DMDD high-risk group tended to be younger, have more psychiatric diagnosis, have lower family income, and have higher paternal psychiatric history. Maternal reports of psychopathology showed more interpersonal problems, anger and hostility, and paranoid symptoms in high-risk group. Children in high-risk group also performed worse in making sense of fearful facial expressions, and social skills.

Similar to neurodevelopmental disorders and disruptive behavioral disorders, male predominance is seen in the epidemiology of DMDD (Haller et al. 2020; Tufan et al. 2016). A large-scale twin study concerning the development of irritability early in life highlighted the importance of environmental effects in boys, whereas genetic burden was the main factor in girls (Roberson-Nay et al. 2015). This study demonstrated a similar rate of DMDD risk in both sexes. In our large, community-based risk group study, girls showed similar irritability characteristics to boys, which contradicts findings from previous studies. However, the term of DMDD risk and DMDD diagnosis may create the main difference between study results, and long-term follow-up studies examining sex/gender differences may be beneficial since DMDD is a newly addressed disorder.

This study showed that the fathers of children in the high-risk group had more psychopathology and their mothers had more difficulties in terms of interpersonal relationships, anger management, and paranoid thoughts. The relationship between irritability and familial psychopathology is believed to involve dual interactions. It has been previously reported that the prevalence of DMDD was higher among the children of parents diagnosed with mood disorders (Sparks et al. 2014; Topal et al. 2021) and that the parents of children diagnosed with DMDD had more psychopathology (Tufan et al. 2016). Poor parenting skills such as negative maternal affect seen in maternal depression and maladaptive parental behavior were predictors of low emotional regulation in children (Angeline et al. 2007). Moreover, negative mood symptoms in mothers during pregnancy and infancy when establishing attachment were predictors of the development of DMDD in the child (Munhoz et al. 2017). This complex interpersonal relation system makes us think that DMDD in the child has a genetic base as well as environmental confounding factors.

In the present study, we observed lower family income level, younger age, and delayed first-word production in the high-risk group, similar to neurodevelopmental disorders (Cuffe, Moore, and McKeown 2005; Geurts and Embrechts 2008). Large-scale community-based studies also indicated that lower family income level poses a risk for the development of DMDD (Copeland, Adrian Angold, and Egger 2013; Munhoz et al. 2017), and the younger age

group is at higher risk for DMDD (Copeland, Adrian Angold, and Egger 2013; Copeland et al. 2015; Eyre et al. 2017). This is consistent with existing knowledge that low-income level and younger age group increases the risk for the developmental psychopathologies in children (Bell and Chimata 2015). The prefrontal cortex, which controls executive functions such as self-control and emotion regulation, continues to mature through adolescence and into early adulthood. Therefore, in addition to causing deviations in development, lack of stimulation and poverty may also affect prefrontal cortex functions and lead to the emotional dysregulation seen in DMDD.

Disruptive behavior disorders such as ADHD, oppositional defiant disorder, and anxiety disorders such as separation anxiety disorder and social anxiety disorder were observed more frequently in the high-risk group. In previous studies, it was reported that children with DMDD had more comorbid psychopathologies, especially neurodevelopmental disorders such as ADHD and dyslexia (Althoff et al. 2016), that almost all had oppositional defiant disorder (de la Vega et al. 2018; Freeman et al. 2016; Mulraney et al. 2016), and that they exhibited more emotional and behavioral problems (Copeland, Adrian Angold, and Egger 2013). Therefore, it is crucial to consider the frequency of comorbid psychopathology in the assessment of DMDD and maintain appropriate interventions for the symptomatology. It should be kept in mind that the group with a high score in CBCL is also a risk group for ADHD, ODD and anxiety disorders as well as DMDD. Studies show that there are difficulties in social relationships and facial emotional recognition in disorders such as ADHD (Da Fonseca et al. 2009), anxiety disorders (Jarros et al. 2012), and ODD (Collin et al. 2013). While evaluating the results of our study, the effects of other disorders that can be seen in the differential diagnosis of DMDD should also be considered.

Additionally, studies on irritability and autism showed that these pathologies have a dual interaction (Argyris et al. 2018; Hommer et al. 2014; Pan and Bin Yeh 2016; Salum et al. 2017). Approximately one-third of children with autism have maladaptive emotional problems (Pan and Bin Yeh 2016) and irritability (Argyris et al. 2018), and autistic children with irritability were reported to have more severe social impairment than those without irritability (Gadow, DeVincent, and Drabick 2008). It has also been reported that children with irritability pay more attention to angry faces (Hommer et al. 2014; Salum et al. 2017), perceive happy facial expressions as fearful (Vidal-Ribas et al. 2018), and interpret ambiguous or neutral facial stimuli as more threatening (Brotman et al. 2010; Stoddard et al. 2016). Our results showed that the high-risk group experienced more difficulties in social interaction, communication, and motor stereotypes and was less accurate in recognizing fearful and intense emotional facial expressions. However, after controlling for the severity of irritability, there was still a significant difference from the control group in terms of social skills, while the two groups showed similar results in the recognition of fearful and intense emotional facial expressions.

High-risk group in this study was formed using a CBCL cutoff score for the DMDD panel, which is calculated as the sum of the CBCL attention, aggression, and anxiety/depression subscale scores. After the effects of irritability/aggression measured with the ARI were controlled for, the difficulty in facial emotional recognition disappeared while social difficulties persisted, which suggests that irritability is more strongly associated with facial emotional recognition, whereas attention and anxiety/depression are more strongly associated with social interaction. Although disorders such as BD, severe mood dysregulation, and ADHD have features similar to DMDD, the findings of studies using functional magnetic resonance imaging show that the DMDD emotional facial expression bias may be related to different neural networks (Guyer et al. 2007; Argyris et al. 2018). Especially in BD and severe mood dysregulation, it has been suggested that significantly more intense facial emotion is needed before the patient can label the emotion correctly, and these deficits may cause more psychosocial impairment (Rich et al. 2008). Moreover, in a recent study using Emotional Word-Face Stroop, the offsprings of BD experienced greater difficulties in resolving cognitive and emotional conflicts (Topal et al. 2021). These results show that there may be problems in perception, processing, and response to emotional stimuli similar to autism in the high-risk group. However, structural and functional neuroimaging studies are needed to determine the origin of the impairment.

Strengths and limitations

The most important limitation of our study is that the risk of DMDD was assessed rather than a diagnosis of DMDD; therefore, our results may elucidate factors related to the risk group but may not reflect those for the psychopathology. Another limitation is that a relatively small group participated in the study. Also, our sample included individuals of a middle-lower socioeconomic status. The risk of DMDD should be evaluated by considering the effects of the socioeconomic level. The strength of our study was that assessments was performed with clinical interviews, valid scales, and a computer-based emotion recognition test, which increases the reliability of our results. To our knowledge, this study is one of the few studies predicting risk factor of DMDD in terms of social skills, and we believe that our results will unveil new perspectives on DMDD.

Conclusion

This study showed that children in the high-risk group had difficulties in social interactions and facial emotion recognition in comparison with their peers. However, after controlling for the severity of the child's irritability, social difficulties persisted while facial emotional recognition skills became similar to those of their peers. These results may suggest that there is closer relationship between irritability and facial emotional recognition, and between attention and anxiety/depression with social interaction. Presence of psychiatric paternal history, maternal hostility, impaired maternal interpersonal relationships, and maternal paranoid thoughts may increase the risk of DMDD in children. Our findings indicate the importance of addressing comorbid diagnoses in children as well as paternal and maternal psychopathology when evaluating children with DMDD.

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Ethical considerations

All the participants, both patients and caregivers, gave written informed consent before the inclusion and all the ethical procedures were performed. The study protocol was approved by the Marmara University School of Medicine Ethics Committee (09.2020.975).

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References

Achenbach, T. M. and C. Edelbrock 1983. "Manual Tor the Child Behavior Checklist/4-18 and Revised Child Behavior Profile." *University of Vermont, Department of Psychiatry, Burlington VT*. (Manual tor the Child Behavior Checklist/4-18 and Revised Child Behavior Profile.).

Althoff, Robert R., Eileen T. Crehan, Jian Ping He, Marcy Burstein, James J. Hudziak, and Kathleen R. Merikangas. 2016. "Disruptive Mood Dysregulation Disorder at Ages 13-18: Results from the National Comorbidity Survey - Adolescent Supplement." *Journal of Child and Adolescent Psychopharmacology* 26(2):107–13. doi:10.1089/cap.2015.0038.

Angeline, Maughan, Dante Cicchetti, Sheree L. Toth, and Fred A. Rogosch. 2007. "Early-Occurring Maternal Depression and Maternal Negativity in Predicting Young Children's Emotion Regulation and Socioemotional Difficulties." *Journal of Abnormal Child Psychology* 35(5):685–703. doi: 10.1007/s10802-007-9129-0.

Antonio, Bruno, Laura Celebre, Giovanna Torre, Gianluca Pandolfo, Carmela Mento, Clemente Cedro, Rocco A. Zoccali, and Maria Rosaria Anna Muscatello. 2019. "Focus on Disruptive Mood Dysregulation Disorder: A Review of the Literature." *Psychiatry Research* 279(May):323–30. doi: 10.1016/j.psychres.2019.05.043.

APA. 2013. *American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders. 5th ed*. doi:10.1176/appi.books.9780890425596.

Argyris, Stringaris, Robert Goodman, Sumudu Ferdinando, Varun Razdan, Eli Muhrer, Ellen Leibenluft, and Melissa A. Brotman. 2012. "The Affective Reactivity Index: A Concise Irritability Scale for Clinical and Research Settings." *Journal of Child Psychology and Psychiatry and Allied Disciplines* 53(11):1109–17. doi: 10.1111/j.1469-7610.2012.02561.x.

Argyris, Stringaris, Pablo Vidal-Ribas, Melissa A. Brotman, and Ellen Leibenluft. 2018. "Practitioner Review: Definition, Recognition, and Treatment Challenges of Irritability in Young People." *Journal of Child Psychology and Psychiatry and Allied Disciplines* 59(7):721–39. doi: 10.1111/jcpp.12823.

Ayaz, Ayşe Burcu, Muhammed Ayaz, and Yanki Yazgan. 2013. "Alterations in Social Reciprocity in Attention-Deficit Hyperactivity Disorder." *Turk Psikiyatri Dergisi*. doi:10.5080/u6800.

Bell, Carl C. and Radhika Chimata. 2015. "Prevalence of Neurodevelopmental Disorders Among Low-Income African Americans at a Clinic on Chicago's South Side." *Psychiatric Services* 66(5):539–42. doi: 10.1176/appi.ps.201400162.

Biederman, Joseph, Spencer Petty, Hyder O'Connor, Surman, and Faraone. 2012. "Longitudinal Course of Deficient Emotional Self-Regulation CBCL Profile in Youth with ADHD: Prospective Controlled Study." *Neuropsychiatric Disease and Treatment* 267:267. doi:10.2147/ndt.s29670.

Boomsma, Dorret I., Irene Rebollo, Eske M. Derks Toos C. E. M. van Beijsterveldt, Robert R. Althoff, David C. Rettew, and James J. Hudziak. 2006. "Longitudinal Stability of the CBCL-Juvenile Bipolar Disorder Phenotype: A Study in Dutch Twins." *Biological Psychiatry* 60(9):912–20. doi:10.1016/J.BIOPSYCH.2006.02.028.

Brotman, Melissa A., Katharina Kircanski, Argyris Stringaris, Daniel S. Pine, and Ellen Leibenluft. 2017. "Irritability in Youths: A Translational Model." *American Journal of Psychiatry* 174(6):520–32. doi:10.1176/appi.ajp.2016.16070839.

Brotman, Melissa A., Brendan A. Rich, Amanda E. Guyer, Jessica R. Lunsford, Sarah E. Horsey, Michelle M. Reising, Laura A. Thomas, Stephen J. Fromm, Kenneth Towbin, Daniel S. Pine, et al. 2010. "Amygdala Activation During Emotion Processing of Neutral Faces in Children with Severe Mood Dysregulation versus ADHD or Bipolar Disorder." *American Journal of Psychiatry* 167(1):61–69. doi: 10.1176/appi.ajp.2009.09010043.

Collin, Lisa, Jasmeet Bindra, Monika Raju, Christopher Gillberg, and Helen Minnis. 2013. "Facial Emotion Recognition in Child Psychiatry: A Systematic Review." *Research in Developmental Disabilities* 34(5):1505–20. doi:10.1016/j.ridd.2013.01.008.

Constantino, John N., Sandra A. Davis, Richard D. Todd, Matthew K. Schindler, Maggie M. Gross, Susan L. Brophy, Lisa M. Metzger, Christiana S. Shoushtari, Reagan Splinter, and Wendy Reich. 2003. "Validation of a Brief Quantitative Measure of Autistic Traits: Comparison of the Social Responsiveness Scale with the Autism Diagnostic Interview-Revised." *Journal of Autism and Developmental Disorders* 33(4):427–33. doi:10.1023/A:1025014929212.

Constantino, John N., Thomas Przybeck, Darrin Friesen, and Richard D. Todd. 2000. "Reciprocal Social Behavior in Children with and without Pervasive Developmental Disorders." *Journal of Developmental and Behavioral Pediatrics* 21(1):2–11. doi: 10.1097/00004703-200002000-00002.

Copeland, William E., E. Jane Costello Adrian Angold, and Helen Egger. 2013. "Prevalence, Comorbidity, and Correlates of DSM-5 Proposed Disruptive Mood Dysregulation Disorder." *American Journal of Psychiatry* 170(2):173–79. doi: 10.1176/appi.ajp.2012.12010132.

Copeland, William E., Dieter Wolke, Lilly Shanahan, and Jane Costello. 2015. "Adult Functional Outcomes of Common Childhood Psychiatric Problems a Prospective, Longitudinal Study." *JAMA Psychiatry* 72(9):892–99. doi:10.1001/jamapsychiatry.2015.0730.

Cuffe, Steven P., Charity G. Moore, and Robert E. McKeown. 2005. "Prevalence and Correlates of ADHD Symptoms in the National Health Interview Survey." *Journal of Attention Disorders* 9(2):392–401. doi:10.1177/1087054705280413.

Da Fonseca, David, Valérie Seguier, Andreia Santos, François Poinso, and Christine Deruelle. 2009. "Emotion Understanding in Children with ADHD." *Child Psychiatry and Human Development* 40(1):111–21. doi: 10.1007/s10578-008-0114-9.

Dağ, Ihsan. 1991. "Reliability and Validity of the Symptom Check List (SCL-90-R) for University Students." *Turkish Journal of Psychiatry* 2: 5–12.

de la Vega, Diego, Ana Piña, J. Francisco, Peralta, A. Sam, Kelly, and Lucas Giner. 2018. "A Review on the General Stability of Mood Disorder Diagnoses Along the Lifetime." *Current Psychiatry Reports* 20(4): doi: 10.1007/s11920-018-0891-1.

Derogatis, L. R., and P. A. Cleary. 1977. "Confirmation of the dimensional structure of the scl-90: A study in construct validation." *Journal of Clinical Psychology* 33(4): 981–89. doi:10.1002/1097-4679(197710)33:4<981::aid-jclp2270330412>3.0.co;2-0.

Erol, Neşe, B. Arksan, and Melda Akçakın. 1995. "The Adaptation and Standardisation of the Child Behavior Checklist Among 6-18 Year-Old Turkish Children." *Eunethydis*, 97–113. European Approaches to Hyperkinetic Disorder.

Eyre, Olga, Kate Langley, Argyris Stringaris, Ellen Leibenluft, Stephan Collishaw, and Anita Thapar. 2017. "Irritability in ADHD: Associations with Depression Liability." *Journal of Affective Disorders* 215:281–87. doi:10.1016/j.jad.2017.03.050.

Freeman, Andrew J., Eric A. Youngstrom, Jennifer K. Youngstrom, and Robert L. Findling. 2016. "Disruptive Mood Dysregulation Disorder in a Community Mental Health Clinic: Prevalence, Comorbidity and Correlates." *Journal of Child and Adolescent Psychopharmacology* 26(2):123–30. doi: 10.1089/cap.2015.0061.

Gadow, Kenneth D., Carla J. DeVincent, and Deborah A. G. Drabick. 2008. "Oppositional Defiant Disorder as a Clinical Phenotype in Children with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 38 (7):1302–10. doi:10.1007/s10803-007-0516-8.

Geurts, Hilde M. and Mariëtte Embrechts. 2008. "Language Profiles in ASD, SLI, and ADHD." *Journal of Autism and Developmental Disorders* 38(10):1931–43. doi:10.1007/s10803-008-0587-1.

Guyer, Amanda E., Erin B. Mcclure, Abby D. Adler, Melissa A. Brotman, Brendan A. Rich, Alane S. Kimes, Daniel S. Pine, Monique Ernst, and Ellen Leibenluft. 2007. "Specificity of Facial Expression Labeling Deficits in Childhood Psychopathology." *Journal of Child Psychology and Psychiatry and Allied Disciplines* 48(9):863–71. doi: 10.1111/j.1469-7610.2007.01758.x.

Haller, Simone P., Katharina Kircanski, Argyris Stringaris, Michal Clayton, Hong Bui, Courtney Agorsor, Sofia I. Cardenas, Kenneth E. Towbin, Daniel S. Pine, Ellen Leibenluft, et al. 2020. "The Clinician Affective Reactivity Index: Validity and Reliability of a Clinician-Rated Assessment of Irritability." *Behavior Therapy* 51(2):283–93. doi: 10.1016/j.beth.2019.10.005.

Hommer, Rebecca E., Allison Meyer, Joel Stoddard, Megan E. Connolly, Karin Mogg, Brendan P. Bradley, Daniel S. Pine, Ellen Leibenluft, and Melissa A. Brotman. 2014. "Attention Bias to Threat Faces in Severe Mood Dysregulation." *Depression and Anxiety* 31(7):559–65. doi:10.1002/da.22145.

Jarros, Rafaela Behs, Giovanni Abrahão Salum, Cristiano Tschiedel Belem da Silva, Rudineia Toazza, Marianna de Abreu Costa, Jerusa Fumagalli de Salles, and Gisele Gus Manfro. 2012. "Anxiety Disorders in Adolescence are Associated with Impaired Facial Expression Recognition to Negative Valence." *Journal of Psychiatric Research* 46(2):147–51. doi:10.1016/j.jpsychires.2011.09.023.

Kocael, Ö. 2015. "*Çocuk ve Ergenlerde Irritabilite: Duygusal Reaktivite Indeksi'nin Türkçe Geçerlilik Güvenilirlik Çalışması*." Unpublished Doctoral Dissertation, Uludağ University Faculty of Medicine.

Kutlu, Ayse, Ulku Akyol Ardic, and Eyup Sabri Ercan. 2017. "Effect of Methylphenidate on Emotional Dysregulation in Children with Attention-Deficit/hyperactivity Disorder + Oppositional Defiant Disorder/Conduct Disorder." *Journal of Clinical Psychopharmacology* 37(2):220–25. doi:10.1097/JCP.0000000000000668.

Mbekou, Valentin, Martin Gignac, Sasha MacNeil, Pamela MacKay, and Johanne Renaud. 2014. "The CBCL Dysregulated Profile: An Indicator of Pediatric Bipolar Disorder or of Psychopathology Severity?" *Journal of Affective Disorders* 155(1):299–302. doi:10.1016/J.JAD.2013.10.033.

Mulraney, Melissa, Elizabeth J. Schilpzand, Philip Hazell, Jan M. Nicholson, Vicki Anderson, Daryl Efron, Timothy J. Silk, and Emma Sciberras. 2016. "Comorbidity and Correlates of Disruptive Mood Dysregulation Disorder in 6–

8-year-old Children with ADHD." *European Child and Adolescent Psychiatry* 25(3):321–30. doi:10.1007/s00787-015-0738-9.

Munhoz, Tiago N., Iná S. Santos, Aluísio J. D. Barros, Luciana Anselmi, Fernando C. Barros, and Alicia Matijasevich. 2017. "Perinatal and Postnatal Risk Factors for Disruptive Mood Dysregulation Disorder at Age 11: 2004 Pelotas Birth Cohort Study." *Journal of Affective Disorders* 215(March):263–68. doi:10.1016/j.jad.2017.03.040.

Nowicki, Stephen and Marshall P. Duke. 1994. "Individual Differences in the Nonverbal Communication of Affect: The Diagnostic Analysis of Nonverbal Accuracy Scale." *Journal of Nonverbal Behavior* 18(1):9–35. doi: 10.1007/BF02169077.

Pan, Pei Yin and Chin Bin Yeh. 2016. "The Comorbidity of Disruptive Mood Dysregulation Disorder in Autism Spectrum Disorder." *Psychiatry Research* 241:108–09. doi:10.1016/j.psychres.2016.05.001.

Perich, Tania, Andrew Frankland, Gloria Roberts, Florence Levy, Rhoshel Lenroot, and Philip B. Mitchell. 2017. "Disruptive Mood Dysregulation Disorder, Severe Mood Dysregulation and Chronic Irritability in Youth at High Familial Risk of Bipolar Disorder." *Australian and New Zealand Journal of Psychiatry* 51(12):1220–26. doi: 10.1177/0004867416672727.

Propper, Lukas, Jill Cumby, Victoria C. Patterson, Vladislav Drobinin, Jacqueline M. Glover, Lynn E. MacKenzie, Jessica Morash-Conway, Sabina Abidi, Alexa Bagnell, David Lovas, et al. 2017. "Disruptive Mood Dysregulation Disorder in Offspring of Parents with Depression and Bipolar Disorder." *British Journal of Psychiatry* 210(6):408–12. doi:10.1192/bjp.bp.117.198754.

Rich, Brendan A., Mary E. Grimley, Mariana Schmajuk, Karina S. Blair, J. R. Blair, and Ellen Leibenluft. 2008. "Face Emotion Labeling Deficits in Children with Bipolar Disorder and Severe Mood Dysregulation." *Development & Psychopathology* 20(2):529–46. doi: 10.1017/S0954579408000266.

Roberson-Nay, Roxann, Ellen Leibenluft, Melissa A. Brotman, John Myers, Henrik Larsson, Paul Lichtenstein, and Kenneth S. Kendler. 2015. "Longitudinal Stability of Genetic and Environmental Influences on Irritability: From Childhood to Young Adulthood." *The American Journal of Psychiatry* 172(7):657–64. doi:10.1176/appi.ajp.2015.14040509.

Salum, Giovanni A., Karin Mogg, Brendan P. Bradley, Argyris Stringaris, Ary Gadelha, Pedro M. Pan, Luis A. Rohde, Guilherme V. Polanczyk, Gisele G. Manfro, Daniel S. Pine, et al. 2017. "Association Between Irritability and Bias in Attention Orienting to Threat in Children and Adolescents." *Journal of Child Psychology and Psychiatry and Allied Disciplines* 58(5):595–602. doi:10.1111/jcpp.12659.

Sparks, Garrett M., David A. Axelson, Haifeng Yu, Wonho Ha, Javier Ballester, Rasim S. Diler, Benjamin Goldstein, Tina Goldstein, Mary Beth Hickey, Cecile D. Ladouceur, et al. 2014. "Disruptive Mood Dysregulation Disorder and Chronic Irritability in Youth at Familial Risk for Bipolar Disorder." *The Journal of the American Academy of Child & Adolescent Psychiatry* 53(4):408–16. doi: 10.1016/j.jaac.2013.12.026.

Stoddard, Joel, Banafsheh Sharif-Askary, Elizabeth A. Harkins, Heather R. Frank, Melissa A. Brotman, Ian S. Penton-Voak, Keren Maoz, Yair Bar-Haim, Marcus Munafò, Daniel S. Pine, et al. 2016. "An Open Pilot Study of Training Hostile Interpretation Bias to Treat Disruptive Mood Dysregulation Disorder." *Journal of Child and Adolescent Psychopharmacology* 26(1):49–57. doi:10.1089/cap.2015.0100.

Topal, Zehra, Nuran Demir, Evren Tufan, Taha Can Tuman, and Bengi Semerci. 2021. "Emotional and Cognitive Conflict Resolution and Disruptive Mood Dysregulation Disorder in Adolescent Offspring of Parents Diagnosed with Major Depressive Disorder, Bipolar Disorder, and Matched Healthy Controls." *Nordic Journal of Psychiatry* 75(6):427–36. doi: 10.1080/08039488.2021.1880635.

Tufan, Evren, Zehra Topal, Nuran Demir, Sarper Taskiran, Uğur Savci, Mehmet Akif Cansiz, and Bengi Semerci. 2016. "Sociodemographic and Clinical Features of Disruptive Mood Dysregulation Disorder: A Chart Review." *Journal of Child and Adolescent Psychopharmacology* 26(2):94–100. doi:10.1089/cap.2015.0004.

Tüğen, Leyla Ezgi, Muhsine Göksu, and Ayşe Burcu Ayaz. 2020. "Disruptive Mood Dysregulation Disorder in a Primary School Sample." *Asian Journal of Psychiatry* 48(August 2019):2018–21. doi:10.1016/j.ajp.2019.101858.

Ünal, S., A. S. Güler, C. Dedeoğlu, B. Taşkın, and Y. Yazgan. (2009). "Social reciprocity in a clinical sample diagnosed with attention deficit hyperactivity disorder: Comparison with the control group obtained from a school sample." Poster presented at the 19th National Congress of Child and Adolescent Psychiatry, Hatay, Turkey.

Vidal-Ribas, Pablo, Melissa A. Brotman, Giovanni A. Salum, Ariela Kaiser, Liana Meffert, Daniel S. Pine, Ellen Leibenluft, and Argyris Stringaris. 2018. "Deficits in Emotion Recognition are Associated with Depressive Symptoms in Youth with Disruptive Mood Dysregulation Disorder." *Depression and Anxiety* 35(12):1207–17. doi:10.1002/da.22810.