


The Relationship Between Parental Affective Temperament Traits and Disruptive Behavior Disorders Symptoms in Children With ADHD

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Ayhan Bilgiç¹, Savaş Yılmaz¹, Özlem Özcan², Ali Evren Tufan³, Sevgi Özmen⁴, Didem Öztop⁴, Ömer Faruk Akça¹, Serhat Türkoğlu⁵, and Ahmet Yar⁶

Abstract

Objective: This study investigated the relationship between parental affective temperaments and the oppositional defiant disorder (ODD) and conduct disorder (CD) symptoms of children with ADHD. **Method:** The sample consisted of 542 treatment-naïve children with ADHD and their biological parents. Children were assessed via both parent- and teacher-rated behavioral disorder scales. Parental affective temperament and ADHD symptoms were measured by self-report inventories. The relationships between psychiatric variables were evaluated using structural equation modeling. **Results:** According to parent-rated behavioral disorder scales, paternal cyclothymic and maternal irritable temperaments were associated with ODD scores, and maternal depressive temperament was associated with CD scores. In terms of teacher-rated behavioral disorder scales, maternal anxious temperament was associated with ODD scores, and paternal cyclothymic and maternal depressive temperaments were associated with CD scores. **Conclusion:** These results suggest that certain parental affective temperaments are related to an increase in symptoms of disruptive behavioral disorders in children with ADHD. (*J. of Att. Dis.* 2018; 22(13) 1235-1245)

Keywords

conduct problems, parental functioning, oppositional defiant disorder

Introduction

ADHD in children has high comorbidity rates with disruptive behavior disorders (DBD; Connor, Steeber, & McBurnett, 2010). The most common is oppositional defiant disorder (ODD), which is characterized by chronic difficulties with emotional and behavioral regulation that often bring the child into conflict with authority figures, but the more severe conduct disorder (CD) involves serious violations of societal rules. A coexisting DBD in children with ADHD is associated with increased dysfunction, such as more severe educational problems and antisocial outcomes (Connor et al., 2010). Therefore, a deeper understanding of the underlying developmental processes in each of the DBD is critical for ADHD participants.

Numerous hereditary and environmental factors have been linked to the development of comorbid DBD in ADHD children. Research during the past few decades has led to an increased recognition of the significance of the association between parental psychiatric problems and DBD symptoms in childhood (Agha, Zammit, Thapar, & Langley, 2013; Breaux, Harvey, & Lugo-Candelas, 2014; Goodman & Gotlib, 1999;

Johnston & Mash, 2001; Margari et al., 2013). Parental psychiatric problems seem to be important not only as an index of inherited risk for comorbid behavioral problems but also because of the effects on parenting practices and the family environment (Agha et al., 2013; Breaux et al., 2014; Goodman & Gotlib, 1999; Tully, Iacono, & McGue, 2008). The adverse effects of ineffective parenting that arise from parental psychiatric problems have been proposed to cause the more severe ADHD symptoms and the development of DBD (Johnston & Mash, 2001; Margari et al., 2013). Thus, the recognition of

¹Necmettin Erbakan University, Konya, Turkey

²Inonu University, Malatya, Turkey

³Izzet Baysal University, Bolu, Turkey

⁴Erciyes University, Kayseri, Turkey

⁵Selcuk University, Konya, Turkey

⁶Konya Education and Research Hospital, Konya, Turkey

Corresponding Author:

Ayhan Bilgiç, Associate Professor, Department of Child and Adolescent Psychiatry, Necmettin Erbakan University, 42090, Meram, Konya, Turkey.

Email: bilgicayhan@yahoo.com

parental psychiatric problems that have a relationship with the development of DBD may be beneficial for both preventing and treating these serious disorders in ADHD participants.

Some research has analyzed the relationship between parental psychiatric disorders and coexisting DBD symptoms in children with ADHD. The vast majority of these studies have focused on parental depression, which is a well-known risk factor for certain psychiatric disorders in early childhood (Agha et al., 2013; Chronis et al., 2003; Gerdes et al., 2007; Harvey, Stoessel, & Herbert, 2011). These studies have typically reported that maternal depression is related to a poor evolution of ADHD in offspring (Agha et al., 2013; Gerdes et al., 2007). The negative influence of parental depression on child behavioral outcomes is not limited to ADHD children, and several longitudinal studies have shown an association between both maternal and paternal depression and child behavioral problems in the general population (Breux et al., 2014; Narayanan & Naerde, 2016). However, data are not universal and research by Kashdan et al. suggested that parental anxiety, but not depression, is related to negative parenting practices that show an independent association with ODD symptoms in ADHD children (Kashdan et al., 2004). A study conducted by O'Connor et al. also pointed to the link between parental anxiety and behavioral problems in children (O'Connor, Heron, Glover, & Alspac Study, 2002). Studies have demonstrated that parents having other psychiatric problems such as ADHD, antisocial behavior, and alcoholism are also associated with a significantly greater risk for disruptive behavior problems in their offspring (Humphreys, Mehta, & Lee, 2012; LeMoine, Romirowsky, Woods, & Chronis-Tuscano, 2015; Loukas, Zucker, Fitzgerald, & Krull, 2003).

Although a gradually increasing number of studies have investigated the association of parental psychiatric disorders with childhood DBD, results are complicated by a reciprocal relationship between these factors. That is, although parental psychiatric disorders are thought to cause behavioral problems in children (Chronis, Gamble, Roberts, & Pelham, 2006; Kashdan et al., 2004; Narayanan & Naerde, 2016), recent data have indicated that behavioral symptoms in children may also trigger mental health problems in their parents (Charles, Bywater, Edwards, Hutchings, & Zou, 2013). Furthermore, a longitudinal study found that child behaviors appear to have a greater influence on parenting practice than parenting practice has on child behaviors (Burke, Pardini, & Loeber, 2008). Another difficulty concerning the evaluation of the effects of parental psychiatric disorders on child behavioral symptoms is that the majority of Axis I psychiatric disorders, including depression and anxiety disorders, usually impact only certain parts of parents' life spans. Therefore, they generally do not have a stable influence on children's mental health during the entire childhood. Unlike the majority of Axis I psychiatric disorders, temperament traits are hypothesized to reflect a biological diathesis for psychiatric

disorders and baseline levels for the reactivity, mood, and energy of a person that remain relatively stable throughout life (Akiskal, Akiskal, Allilaire, et al., 2005; Fisher, Island, Rich, Marchalik, & Brown, 2015). Thus, to clarify the impact of a parental psychiatric status on DBD symptoms, an investigation into the association between parental temperament features and coexisting DBD may be fruitful.

Several studies have investigated the temperament traits of the parents of children with ADHD (Instanes, Haavik, & Halmoy, 2013; Steinhausen et al., 2013; Yurumez, Yazici, Gumus, Yazici, & Gursoy, 2014). However, to our knowledge, no previous study has examined the link between parental temperament and child behavioral problems. Temperament has been described using various models in the literature (Akiskal, Akiskal, Haykal, Manning, & Connor, 2005; Cloninger, Svrakic, & Przybeck, 1993; Fisher et al., 2015). Affective temperament is one of the most utilized models in research; it is characterized by five main affective dimensions: depressive, cyclothymic, hyperthymic, irritable, and anxious (Akiskal, Akiskal, Haykal, et al., 2005). Its dimensions lie on a continuum from normality to pathology, and they can frequently serve as markers of vulnerability for affective disorders (Rihmer, Akiskal, Rihmer, & Akiskal, 2010). Besides affective disorders, recent research has indicated that affective temperaments are also associated with distinct patterns of psychopathology and impairment including anxiety disorders, suicidality, insecure attachment, and drug addiction (Asik et al., 2015; Harnic et al., 2014; Karam et al., 2015; Marenmani et al., 2009). Therefore, affective temperaments seem to reflect a general susceptibility or sub-clinical variants of a variety of psychiatric problems.

The present study was undertaken to determine whether the affective temperament traits of biological parents are related to the ODD and CD symptoms in children who have been diagnosed ADHD. In addition to parental temperament and child behavioral symptoms, parental ADHD scores, educational levels, and ages were taken into account because of their potential impact on behavioral problems in ADHD children (Agha et al., 2013; Gerdes et al., 2007; Ghanizadeh, 2015; Krishnaswamy, Subramaniam, Ramachandran, Indran, & Abdul Aziz, 2011). Parental reports of child behavior may be affected by the parent's own psychiatric status; therefore, children's ADHD and coexisting DBD symptoms were measured by both parental and teacher reports to reduce the probability of bias. It was hypothesized that certain affective temperament features of parents are related to more severe ODD and CD symptoms in offspring.

Materials and Method

Participants

All consecutive referrals for ADHD to child and adolescent psychiatry outpatient clinics at six distinct regional tertiary

centers in Turkey were enrolled in this study. All participants were Caucasian, 6 to 18 years of age, and living with both of their biological parents, and they were typically the first to present at clinics with suspected ADHD. Exclusion criteria included the diagnosis of a major physical or neurological illness, autism spectrum disorders, schizophrenia, bipolar disorder, and/or substance abuse/dependence. Patients were also excluded if they had an intelligence quotient (IQ) score below 70 according to the Turkish version of the Wechsler Intelligence Scale for Children–Revised (WISC-R; Savasır & Şahin, 1995; Wechsler, 1974) or if their parents had an educational level of less than 5 years. Children who had a history of taking psychiatric medications were also excluded. When more than one child from the same family met the inclusion and exclusion criteria, one child was randomly selected.

Measures/Instrumentation

Kiddie Schedule for Affective Disorders and Schizophrenia–Present and Lifetime version (K-SADS-PL). The K-SADS-PL is a semi-structured diagnostic interview tool that inquires about current and past episodes of child and adolescent psychiatric disorders and allows for a diagnosis to be made (Kaufman et al., 1997). The Turkish version of the K-SADS-PL was reported to have a good test–retest and inter-rater reliability (Gokler et al., 2004). For the current study, the ADHD module of the K-SADS-PL was used to make the ADHD diagnoses.

Turgay DSM-IV-Based Child and Adolescent Behavioral Disorders Screening and Rating Scale (T-DSM-IV-S). This scale was developed by Turgay and evaluates ADHD, ODD, and CD based on the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; DSM-IV; American Psychiatric Association, 1994) diagnostic criteria (Turgay, 1994). T-DSM-IV-S is a four-point Likert-type scale composed of 41 items. Within this scale, nine items measure severe hyperactivity-impulsivity, nine items measure attention deficit, eight items measure oppositional defiant behavior, and 15 items measure symptoms of CD. The scale was completed by parents and teachers. It was adapted for the Turkish population by Ercan (Ercan, Amado, Somer, & Cıkoglu, 2001).

WISC-R. The WISC-R was designed to measure the IQ of children between the ages of 6 and 16 (Wechsler, 1974). The standardization of the WISC-R for Turkish children was conducted by Savaşır and Şahin (Savaşır & Şahin, 1995). In the present study, it was used to ensure that participants had an IQ of 70 or higher.

Temperament Evaluation of Memphis, Pisa, Paris, San Diego Autoquestionnaire (TEMPS-A). The TEMPS-A was originally developed by Akiskal et al. to assess dimensions of affective temperament (Akiskal, Akiskal, Haykal, et al., 2005).

The Turkish version of TEMPS-A is composed of 100 dichotomous items assessing affective temperament in psychiatric and healthy participants. An individual responds to items with “yes” or “no,” and the participant’s entire life history is taken into account. It covers five temperament dimensions: depressive, cyclothymic, hyperthymic, irritable, and anxious temperaments. The total score of the subscales is determined by the sum of the item scores. The validity and reliability of TEMPS-A for Turkish speakers have been proven by Vahip et al. (Vahip et al., 2005).

The Adult ADHD Self-Report Scale (ASRS). The ASRS is an 18-item self-report inventory in which each item is rated on a five-point Likert-type scale ranging from *never* to *very often* (Adler et al., 2006; Dogan, Oncu, Varol-Saracoglu, & Kucukgoncu, 2009). It consists of 18 items that contain inattention and hyperactivity subscales. Mothers and fathers each completed the ASRS to assess the severity of current ADHD symptoms in themselves.

Sociodemographic variables. Information on demographics and parental education status was obtained from each family.

Procedures

Ethical approval for the study was obtained from the local ethical committee. Parents of children who agreed to participate in the study gave informed written consent. Verbal consent was also given by all the children and their parents. All the study procedures were in accordance with the Declaration of Helsinki and local laws and regulations. At first, both the target child and a parent were interviewed by a child and adolescent psychiatrist using the K-SADS-PL, and ADHD diagnoses were made according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association, 2000) criteria. Participants’ genders, ages, and parental educational levels were recorded. The T-DSM-IV-S was completed by both the parents and teachers of the children. Then, both fathers and mothers filled out the TEMPS-A and ASRS scales. In all the questionnaires, a higher score indicated greater symptomatology. When the clinicians deemed it necessary, the WISC-R was also used to rule out any intellectual disability in children who were aged 16 years or younger. The tests were administered by expert psychologists with specific training and experience in their administration. The WISC-R cannot be used for children more than 16 years of age, however, none of the participants older than 16 required an IQ test to rule out intellectual disability in our participant cohort.

Statistical Analysis

The analysis of the data was performed using SPSS 20.0 AMOS statistical software (SPSS, Inc., Chicago, Illinois,

USA). Zero-order bivariate Pearson or Spearman correlation coefficients were calculated to examine the relationship between the psychiatric test scores. Structural equation modeling (SEM) was further conducted to determine the relationship between psychiatric test scores. To evaluate the goodness-of-fit of a model, the relative/normed chi-square (χ^2/df), the root mean square error of approximation (RMSEA) statistic, the comparative fit index (CFI), and Tucker–Lewis Index (TLI) were used. Although there is no consensus regarding an acceptable ratio for the χ^2/df , authors typically recommend that it be under 2.0 (Tabachnick & Fidell, 2007). For RMSEA, the lower limit is close to 0, and the upper limit should be less than 0.08 for a well-designed model. For CFI and TLI, a cut-off criterion of ≥ 0.95 has been recommended (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). An acceptable model would fulfill all these parameters.

Because the scores for symptoms of ADHD and coexisting DBD were measured with both parent- and teacher-rated T-*DSM-IV-S* scales, the relationship between the parental TEMPS-A and ADHD scores and the children's DBD scores were examined with two separate models. Parental TEMPS-A and ADHD scores and child ADHD scores were determined as predictor variables, whereas child ODD and CD scores were determined as outcome variables. Because the ages and genders of the children and the ages and education levels of the parents may have an impact on psychiatric measures, the effects of these variables were controlled in our models. Covariant effects among each of the predictor variables were also assessed. Estimates of the path coefficient in SEM analyses reflect the strength of the path between predictor and outcome variables and were calculated by standardized regression coefficients (i.e., β value). The significance was set at a level of .05 (two-tailed) in this analysis.

Results

A total of 611 parents were approached, but 18 of the parents refused to participate, and only 593 provided written consent. Fifty-one children were excluded based on the exclusion criteria. Thus, the sample consisted of 542 children who satisfied the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., *DSM-5*; American Psychiatric Association, 2013) symptom and impairment criteria for ADHD. Of the 542 children, 409 met the *DSM-5* criteria for ADHD-combined type, 107 children met the criteria for ADHD-predominantly inattentive type, and 26 children met the criteria for ADHD-predominantly hyperactive-impulsive type. The mean age of the children was 9.4 ± 2.8 years (range = 6-18 years); the sample consisted of 436 (80.4%) boys and 106 (19.6%) girls. The mean age of the mothers and fathers in the sample was 34.9 ± 5.9 years (range = 24-54 years) and 38.6 ± 6.3 years (range = 28-62 years), and

the mean mothers' and fathers' educational levels were 8.4 ± 3.7 years (range = 5-17 years) and 9.6 ± 3.9 years (range = 5-17 years), respectively. Means, standard deviations, and zero-order correlations for the psychological test scores are given in Table 1. No significant differences in age or sex were observed between the refusal and excluded groups and the sample group.

The association between parental TEMPS-A and ADHD scores and the parent-rated ADHD and DBD scores of the children were examined in Model 1 (Figure 1). This model showed positive effects of the paternal TEMPS-A cyclothymic and maternal TEMPS-A irritability scores on the ODD scores of T-*DSM-IV-S* ($\beta = .09, p = .011$; $\beta = .17, p < .001$, respectively) and of the maternal TEMPS-A depressive scores on the CD scores of T-*DSM-IV-S* ($\beta = .09, p = .006$). There were also positive relationships between the inattention and hyperactivity-impulsivity scores of T-*DSM-IV-S* and the ODD scores of T-*DSM-IV-S* ($\beta = .25, p < .001$; $\beta = .41, p < .001$, respectively) and between the ODD scores of T-*DSM-IV-S* and the CD scores of T-*DSM-IV-S* ($\beta = .63, p < .001$). However, neither paternal nor maternal ADHD scores were directly associated with ODD or CD scores. Overall, the model fit the data satisfactorily ($p < .001$, $\chi^2/df = 1.604$, RMSEA = .033, TLI = .965, and CFI = .973). Significant regression relationships of this model are given in Figure 1.

The association of parental TEMPS-A and ADHD scores with the teacher-rated ADHD and DBD scores of the children were examined in Model 2 (Figure 2). This model showed positive effects of the maternal TEMPS-A anxious scores on the ODD scores of T-*DSM-IV-S* ($\beta = .07, p = .034$) and of the paternal TEMPS-A cyclothymic and maternal TEMPS-A depressive scores on the CD scores of T-*DSM-IV-S* ($\beta = .07, p = .012$; $\beta = .09, p = .003$, respectively). There were also positive relationships between the inattention and hyperactivity-impulsivity scores of T-*DSM-IV-S* and the ODD scores of T-*DSM-IV-S* ($\beta = .16, p < .001$; $\beta = .59, p < .001$, respectively) and between the ODD scores of T-*DSM-IV-S* and the CD scores of T-*DSM-IV-S* ($\beta = .71, p < .001$). However, neither paternal nor maternal ADHD scores were directly associated with ODD or CD scores. Overall, the model fit the data satisfactorily ($p < .001$, $\chi^2/df = 1.629$, RMSEA = .034, TLI = .965, and CFI = .973). Significant regression relationships of this model are given in Figure 2.

Discussion

The present study underscores the association between parental affective temperament features and behavioral problems in children with ADHD. We have provided preliminary evidence for the influence of maternal anxious and irritable temperaments and paternal cyclothymic temperaments on ODD symptoms and for the maternal depressive

Table 1. Intercorrelations among psychiatric variables.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1. Parent T-DSM-IV-S Inattention		.39***																				
2. Parent T-DSM-IV-S HI		.53***																				
3. Parent T-DSM-IV-S ODD		.66***																				
4. Parent T-DSM-IV-S CD		.41***																				
5. Teacher T-DSM-IV-S Inattention		.44***																				
6. Teacher T-DSM-IV-S HI		.64***																				
7. Teacher T-DSM-IV-S ODD		.73***																				
8. Teacher T-DSM-IV-S CD		.16***																				
9. Maternal TEMPS-A Depressive		-.15***																				
10. Maternal TEMPS-A Cyclothymic		-.10*																				
11. Maternal TEMPS-A Hypertymic		.13**																				
12. Maternal TEMPS-A Irritable		.59***																				
13. Maternal TEMPS-A Anxious		.24***																				
14. Paternal TEMPS-A Depressive		.17***																				
15. Paternal TEMPS-A Cyclothymic		.14**																				
16. Paternal TEMPS-A Hypertymic		.55***																				
17. Paternal TEMPS-A Irritable		.14**																				
18. Paternal TEMPS-A Anxious		.63***																				
19. Maternal ASRS Inattention		.13**																				
20. Maternal ASRS Hyperactivity		.62***																				
21. Paternal ASRS Inattention		.13**																				
22. Paternal ASRS Hyperactivity		.61***																				

Note. T-DSM-IV-S = Turgay DSM-IV-Based Child and Adolescent Behavioral Disorders Screening and Rating Scale; HI = hyperactivity-impulsivity; ODD = oppositional defiant disorder; CD = conduct disorder; TEMPS-A = Temperament Evaluation of Memphis, Pisa, Paris, San Diego Autoquestionnaire; ASRS = Adult ADHD Self-Report Scale.

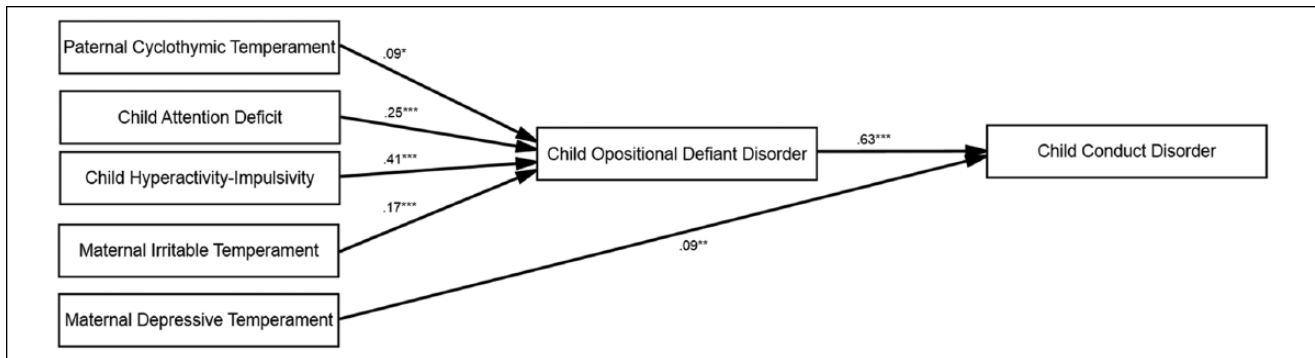


Figure 1. The relationships between parental affective temperament and parent-rated disruptive behavior disorders symptoms of children with ADHD.

Note. Model fit values: $\chi^2/df = 1.604$; comparative fit index = .973; Tucker–Lewis index = .965; root mean square error of approximation = .033. * $p < .05$. ** $p < .01$. *** $p < .001$.

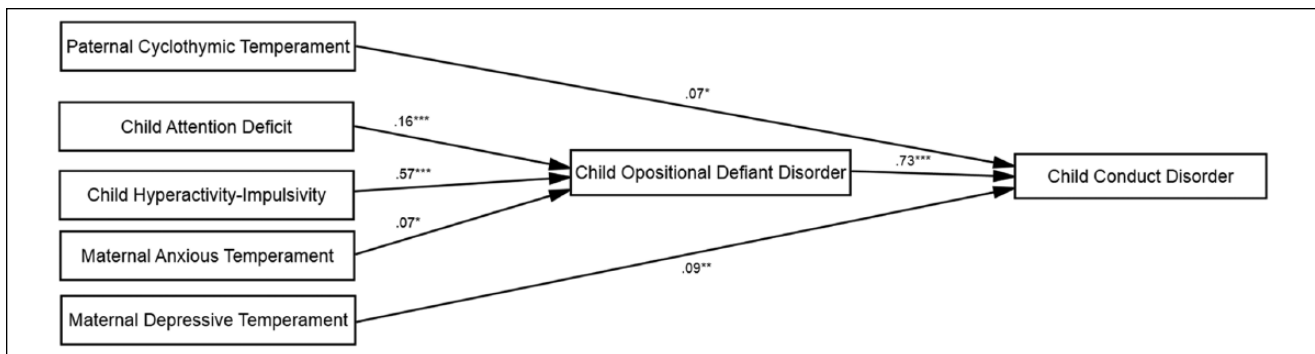


Figure 2. The relationships between parental affective temperament and teacher-rated disruptive behavior disorders symptoms of children with ADHD.

Note. Model fit values: $\chi^2/df = 1.629$; comparative fit index = .973; Tucker–Lewis index = .965; root mean square error of approximation = .034. * $p < .05$. ** $p < .01$. *** $p < .001$.

and paternal cyclothymic temperaments on CD symptoms in ADHD participants. These findings may have important clinical implications; if a child with ADHD has more severe accompanying DBD symptoms, it may be important to focus on parental temperaments during clinical assessment.

Our findings showed that the positive association of maternal anxious temperament with child oppositional defiant behaviors exhibited by ADHD children may be consistent with research showing the escalating effects of maternal anxiety on child behavioral problems. Several longitudinal studies have demonstrated that newborn children exposed to elevated levels of maternal anxiety during the antenatal period showed poor behavioral outcomes later (Leis, Heron, Stuart, & Mendelson, 2014; O'Connor et al., 2002). In a recent study, Middeldorp et al. found that maternal anxiety was associated with offspring oppositional defiant behaviors in a group of school-age children and adolescents (Middeldorp et al., 2016). So far, the potential mechanisms of the link between maternal anxiety or anxious temperament and oppositional defiant behaviors have not been

clear. In an experimental study, Whaley et al. showed that anxious mothers were less warm and positive in parent–child interactions, less granting of autonomy, and more critical and catastrophizing compared with healthy mothers even after controlling for depressive symptoms (Whaley, Pinto, & Sigman, 1999). Another study has also demonstrated the negative impact of parental anxiety on parenting practices (Kashdan et al., 2004). Given the importance of parenting for the development of ODD (Burke et al., 2008; Pederson & Fite, 2014), a maternal anxious temperament may show its influences on oppositional defiant behaviors in children through an impairment of parenting practices. Future studies evaluating the potential mediator roles of parenting practices may shed light on the link between a maternal anxious temperament and childhood ODD.

The present study indicated an increasing effect of maternal irritable temperament on parent-rated ODD symptoms. Irritability is characterized as a low threshold for experiencing anger in response to psychological distress and commonly occurs as a part of the clinical presentation of a variety of psychiatric disorders, including depression

and anxiety disorders. Until now, very little information has been available regarding the relationship between parental irritability and children's mental health (Erermis et al., 2009). However, there is indirect evidence from studies that have investigated the influence of some third variables that are closely associated with irritability on childhood behavioral outcomes (Deater-Deckard, Sewell, Petrill, & Thompson, 2010; Deater-Deckard, Wang, Chen, & Bell, 2012). For example, executive function deficit has been found to be related to irritability (Rosenberg et al., 2011), and two different studies conducted by Deater-Deckard et al. demonstrated that poor maternal executive function is significantly related to harsh, reactive parenting and childhood behavioral problems (Deater-Deckard et al., 2010; Deater-Deckard et al., 2012). Oppositional and defiant behaviors of children are challenging to manage, and when faced with these behaviors, a parent must regulate her or his own thoughts and emotions and use effective parenting styles to reduce the probability of the development of stable behavioral problems in offspring (Deater-Deckard et al., 2012). Therefore, it may be speculated that maternal irritable temperaments may cause negative parenting styles via an impairment of parental emotion regulation and consequently, may lead to the development or escalation of ODD symptoms. Future studies should examine this topic.

Our results showed that paternal cyclothymic temperament had an increased effect on parent-rated ODD and teacher-rated CD symptoms of ADHD children. To our knowledge, data were lacking regarding the association between parental cyclothymic temperament and child functioning. It has been well established that harsh and inconsistent parenting—which can trigger the development of disturbed child–parent interactions—has been linked to subsequent externalizing problems (Jaffee, Strait, & Odgers, 2012). Cyclothymic temperament is an inherent disposition of affective dysregulation and emotional overactivity, and it involves change from periods of abundant energy and self-confidence to periods of lack of energy and self-doubt (Akiskal, 1995; Parker, McCraw, & Fletcher, 2012). Therefore, it may be suggested that cyclothymic temperament features cause fathers to have difficulty organizing parenting tasks and cause them to use a more dysfunctional and wavering parenting style, which can lead to the development of behavioral problems in children. However, a cyclothymic temperament makes individuals particularly vulnerable to the development of a variety of psychiatric conditions, such as bipolar disorder, major depressive disorder, suicidality, impulsivity, and an insecure attachment style (Del Carlo, Benvenuti, Toni, Dell'osso, & Perugi, 2013; Harnic et al., 2014; Kochman et al., 2005). Thus, it may also show its escalating effect on child behavioral problems that are secondary to the triggering of these psychiatric problems in fathers.

In our sample, maternal depressive temperament was associated with both parent- and teacher-rated CD symptoms in ADHD children. These results suggest that exposure to a mother with a depressive temperament increases serious rule violations in ADHD participants. No previous study has investigated the impact of parental depressive temperament on children's behavioral problems. However, a handful of studies have documented the link between maternal depression and negative behavioral outcomes in children (Agha et al., 2013; Breaux et al., 2014; Harold et al., 2011; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005; Narayanan & Naerde, 2016; Silberg, Maes, & Eaves, 2010; Tully et al., 2008). Although this relationship is at least partly genetic, adopted-away offspring and *in vitro* fertilization studies have provided evidence for the direct environmental impact of maternal depression that is independent of any genetic liability parents and children share (Harold et al., 2011; Silberg et al., 2010; Tully et al., 2008). An intervention study has also elucidated the importance of maternal depression as an environmental factor affecting offspring, demonstrating an improvement in children's psychiatric symptoms following treatment of maternal depression (Pilowsky et al., 2008). Furthermore, a dose–response relationship between maternal depression and child antisocial behavior has been reported (Kim-Cohen et al., 2005). Compared with maternal depression, the association between paternal depression and child psychopathology has received scant attention. However, recent longitudinal studies have indicated that paternal depression has deleterious effects on child functioning (Breaux et al., 2014; Herbert, Harvey, Lugo-Candelas, & Breaux, 2013). Many studies posit that parenting and family environments mediate the relationship between maternal depression and poor behavioral outcomes for children (Charles et al., 2013; Dietz, Jennings, Kelley, & Marshal, 2009). Therefore, one might hypothesize that depressive temperament in mothers may have a negative influence on ADHD children through similar mechanisms. This hypothesis must be evaluated through additional studies; the present study could not provide any data concerning this possibility.

Our models did not show a specific regression relationship between parental ADHD and child disruptive behaviors after accounting for parental temperament. Previous studies have observed that both maternal and paternal ADHD have a unique effect on behavioral problems in offspring that are independent of symptoms of other Axis I and II psychiatric disorders (Breaux et al., 2014; Humphreys et al., 2012; Kessler et al., 2006). ADHD is theorized to have links with temperament traits (Nigg, 2006). Thus, our results might show the importance of taking into account temperament traits when assessing the effects of parental ADHD as a risk marker for the subsequent onset of behavioral problems in children with ADHD.

One of the main limitations of this study is its cross-sectional nature, which entails the standard limitations on drawing conclusions concerning the direction of transmission from parent to child. Another limitation was the lack of inclusion of parental psychiatric disorders—excepting ADHD and specific parenting styles—that mediate the link between parental affective temperament and child behavioral problems. We did not include children who did not live with both of their biological parents. These criteria improved our ability to examine the effects of both paternal and maternal temperaments on child clinical presentation. However, the exclusion of data from single parent families prevents this sample from being fully representative of families with ADHD children. In addition, we were unable to examine the influences of parent affective temperament separately by child gender because our sample included only a small number of girls. Although our study specifically aimed to investigate the influence of parental affective temperament on child behavioral outcomes, the lack of control participants may also be regarded as a limitation. Finally, the fact that the sample of the present study is composed of children with a clinical diagnosis of ADHD may affect the generalization of the results, which cannot be extrapolated to a non-clinical sample.

In summary, this study focused on the link between parental affective temperament and DBD symptoms in children with ADHD. Findings from this study showed that depressive, anxious, and irritable affective temperaments in the mother and a cyclothymic affective temperament in the father may have an impact on the behavioral problems of children. Factors that can worsen the prognosis of ADHD are of critical importance when considering treatment and intervention strategies that can attenuate the consequences of the disorder. Therefore, screening parents during the assessment of the child and the elucidation of potential mediators of the association between parental temperament and child behavioral outcomes may have important clinical implications. Future research is needed to better understand the mechanisms underlying the relationship between parental temperament traits and behavioral functioning in ADHD children.

Declaration of Conflicting Interests

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Author Biographies

Ayhan Bilgiç, MD, is an associate professor of child and adolescent psychiatry at the Necmettin Erbakan University. He is interested in ADHD, aggression, and psychosomatic medicine.

Savaş Yılmaz, MD, is an associate professor of child and adolescent psychiatry at the Necmettin Erbakan University. He is interested in ADHD and Internet addiction.

Özlem Özcan is a professor of child and adolescent psychiatry at the Inonu University. Her interests include ADHD and autism spectrum disorder.

Ali Evren Tufan, MD, is an associate professor of child and adolescent psychiatry at the Izzet Baysal University. He is interested in biological psychiatry.

Sevgi Özmen, MD, is an assistant professor of child and adolescent psychiatry at the Erciyes University. Her interests include ADHD and autism spectrum disorder.

Didem Öztop, MD, is an associate professor of child and adolescent psychiatry. She is interested in autism spectrum disorder and ADHD.

Ömer Faruk Akça, MD, is an associate professor of child and adolescent psychiatry at the Necmettin Erbakan University. He is interested in ADHD and anxiety disorders.

Serhat Türkoğlu is an associate professor of child and adolescent psychiatry at the Selcuk University. He is interested in psychopharmacology and psychosomatic medicine.

Ahmet Yar, MD, is a child psychiatrist. His interests include clinical and developmental psychiatry.