

Original Article**Effects of parent training on salivary cortisol in children and adolescents with disruptive behavior disorder**

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**Abstract**

**BACKGROUND:** Since adulthood antisocial, aggressive and delinquent behaviors often have their onset early in life, investigating the association between biological factors and disruptive behaviors in children and adolescents are important and are emphasized on in the recent years. Baseline cortisol level seems to be a valuable biological marker of individuals with Disruptive Behavior Disorder (DBD). This study examined the effect of parent training on salivary cortisol levels of children with DBD.

**METHODS:** Saliva samples were assayed to determine cortisol levels in nineteen clinic-referred children with DBD (aged 8 through 13 years) before and after an eight-session parent training program. Children's disruptive behaviors were assessed by Child Behavior Check List before and after the intervention.

**RESULTS:** Children's salivary cortisol increased significantly after parent training sessions. Children with DBD who had lower basal cortisol levels had more severe disruptive behaviors and a better response to intervention by parent training as assessed by changes in cortisol levels and disruptive behaviour scores. However, post-interventional reduction of disruptive behaviors and increase in cortisol level was significant for all levels of baseline cortisol.

**CONCLUSIONS:** Parent training is an effective method for behavioral modification in DBD. Salivary cortisol may be considered a predictive factor for severity of the child or adolescent's disruptive behaviors and also for response of those behaviors to parent training.

**KEY WORDS:** Disruptive behavior, child, adolescent, parent training.

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**O**ppositional and antisocial behaviors are the most frequent referral concern for the youth seen in mental health clinics, accounting for one-third to one-half of all cases. So, it is not surprising that Disruptive

Behavior Disorder (DBD) has been allocated as a separate diagnostic category <sup>1-3</sup> including Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD) <sup>4</sup>. Children with these disorders are at high risk of criminality and

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antisocial personality disorder in adulthood<sup>5</sup>. These behavior patterns cause distinct difficulties in school life as well as in peer relationships<sup>1,2</sup>. Convincing evidence of causal linkage between multiple domains of this disorder remains elusive. Research has questioned the notion that these disorders are intractable, especially when multiple domains of risk and impairment are the targets of intervention<sup>6</sup>. Effective methods to treat these children are therefore important<sup>3,6</sup>. On the other hand, since antisocial, aggressive and criminal behaviors often have their onset early in life<sup>7,8</sup> it is important to investigate associations between biological factors and disruptive behaviors in children and adolescents. There is fairly convincing evidence that antisocial individuals are characterized by reduced skin conductance levels and heart rate, which both have a predictive relationship with later antisocial behavior<sup>3</sup>. These disorders are also often thought to be associated with low activity of Hypothalamic-Pituitary-Adrenal axis (HPA)<sup>7,9-11</sup>. Two influential theories have postulated an association between disruptive behaviors and low arousal level<sup>10</sup>. According to the first, the fearless theory, a low tendency to become aroused in reaction to fearful stimuli would result in a higher likelihood to become disruptive<sup>12</sup>. Hence, based on the fearless theory, an association between high disruptive behavior levels and low HPA-axis activity could be expected<sup>9</sup>. The second is the sensation-seeking theory, which states that low arousal level is an unpleasant physiological state<sup>12</sup> and to get rid of this state, individuals with low arousal would seek stimulation, for instance by initiating antisocial behaviors that increase physical tension<sup>7,12</sup>. One of the most provocative neuro-endocrinologic findings reported in ODD and CD is the abnormal basal cortisol concentration as the end product of HPA axis<sup>3,11,13-15</sup>. Several studies have found an inverse relationship between cortisol level and disruptive behaviors<sup>3,11,13,14,16,17</sup>, but there are also some other studies which have found no such relationship<sup>18,19</sup>. However it seems that both basal cortisol and

cortisol under the stress could be valuable biological characteristics of individuals with DBD. Only a small number of studies have been conducted on the predictive value of basal cortisol levels for later aggressive behaviors<sup>11</sup>. Despite the fact that parent training and other family psychotherapeutic interventions are considered as the most important treatment methods for DBD<sup>1,2</sup>, one area that has been received too little attention is the examination of the relationships between cortisol levels and outcome of psychotherapeutic interventions. In this study we compared basal cortisol levels of children with DBD before and after parent training while also evaluating the association of the post-interventional changes in cortisol levels with those changes in children's symptom severity.

## Methods

### *Trial organization*

This was an open-label trial study undertaken in Isfahan Child and Adolescent Guidance Clinic (ICAGC) in 2006-2007.

### *Participants*

The subjects were 19 outpatient children and adolescents (16 boys and 3 girls) aged 8-13 years old who met the criteria of the Diagnostic and Statistical manual of Mental disorder, Forth edition text revision (DSM-IV-TR) for DBD<sup>4</sup>. They were recruited from the ICAGC. The diagnosis of DBD was made by a child and adolescent psychiatrist according to the DSM-IV-TR criteria through clinical interview with the child or the adolescent. Inclusion criteria were: a) age between 8-13 years, b) no history of psychotropic drug use, c) intelligent quotient (IQ)>80 according to Wechsler's Intelligence Scale for Children-Revised (WISC-R)<sup>20</sup>, d) no physical illness, e) scored above 95 percentile for aggressive and delinquent behaviors according to the Child Behavioral Check List (CBCL)<sup>21-23</sup>. The child or adolescent was excluded in the case of: a) medication use, b) parents' absenteeism in two or more training sessions, c) having allergy or being sick on the date of salivary collection.

### Study Design

All subjects were interviewed by a child and adolescent psychiatrist to confirm the diagnosis of DBD and specify its subtypes. Also a medical history was taken to rule out any physical illness. Patients were assessed by CBCL test (parents' report) before parent training program and after that (two months later). This test has a reliability over 90%, with high content validity<sup>21-23</sup>. The total duration of training program was 2 months but the training itself was completed one week before the last session, which was designed as the summing up and farewell meeting. Saliva samples were collected at 7-8 am<sup>16,24-27</sup> on the mornings, before the first session and after the farewell one. Salivary cortisol is a valuable indicator of free plasma cortisol level in the absence of stress or injection and salivary cortisol level is believed to be independent of the amount of

saliva secretion<sup>16,24,28</sup>. Saliva samples were collected in plastic vials after saliva secretion was stimulated by citric acid and were stored at -20 °C before analysis. Saliva cortisol levels were measured without applying any extraction procedure. Competitive radio-immunoassay with a polyclonal anticortisol antibody (K 7348) [1,2 <sup>3</sup>H(N)] Hydrocortisone (NET 185, NEN- Dupont, Dreich, Germany) was used as a tracer after chromatographic verification of its purity. Salivary cortisol tests were done at Noor Hospital Laboratory (Isfahan/ Iran). The lower limit of detection was 0.5 nmol/l and interassay variation was 11%, 8.2%, and 7.6% at 4.7, 9.7, and 14.0 nmol/l, respectively (n = 10). Parents of the subjects participated in the 8-session parent training program designed according to the triple P method<sup>29</sup> (table 1)

**Table 1.** The curriculum of parent training: Triple P

Session	Duration (hours)	Content
1 <sup>st</sup> week	2	Positive parenting
2 <sup>nd</sup> week	2	Promoting children development
3 <sup>rd</sup> week	2	Managing misbehaviors
4 <sup>th</sup> week	2	Planning ahead
5 <sup>th</sup> week	2	Implementing parenting routine I
6 <sup>th</sup> week	2	Implementing parenting routine II
7 <sup>th</sup> week	2	Implementing parenting routine III
8 <sup>th</sup> week	2	Program closing

In these sessions, a child and adolescent psychiatrist trained the parents about behavioral modification and how to manage and deal with children suffering from DBD. Parents completed written informed consent forms for their own and their children participation.

### Statistical Analysis

Data were analyzed by Statistical Package for Social Sciences (version 11) (SPSS-11) software using paired t- test to compare the mean cortisol levels and CBCL scores before and after intervention. Correlations between cortisol levels and CBCL score were examined and a P-value less than 0.05 was considered significant. Descriptive analyses were used to demonstrate demographic data.

### Results

Among 19 subjects with DBD, 16 (84.2 %) were boys and 3 (15.8 %) were girls. Sixteen children were diagnosed to suffer from ODD and 3 from CD. Co-morbidity with Attention Deficit Hyperactivity Disorder (ADHD) was diagnosed in 15 children (table 2).

**Table 2.** Age groups of subjects.

Age group (year-old)	Frequency (N)	Prevalence (%)
8- 9	6	31.6
10- 11	8	42.1
12- 13	5	26.3
8- 13	19	100

The mean salivary cortisol level before and after parent training was  $7.9 \pm 4.6$  nmol/l and  $10.48 \pm 3.84$  nmol/l, respectively ( $P < 0.001$ ) indicating a statistically significant difference between cortisol levels before and after intervention ( $t = -4.213$ ,  $df = 18$ ). CBCL scores are presented in table 3. Paired t-test showed a significant reduction of the mean CBCL score

after parent training (table 4).

**Table 3.** CBCL scores before and after treatment.

CBCL	Mean	SD	N
Before treatment	72.05	10.11	19
After treatment	49.36	11.18	19

T = 9.385, df = 18, P < 0.0001

**Table 4.** Correlations between mean CBCL scores and salivary cortisol measures.

Mean cortisol level		Mean CBCL score before treatment	Mean CBCL score after treatment
Before treatment	Pearson correlation	0.511	-0.358
	Significance	0.025*	0.132*
After treatment	Pearson correlation	0.546	-0.481
	Significance	0.016*	0.037*

\*Correlation is considered significant at the 0.05 value of P.

There was a reverse correlation between disruptive behavior score of CBCL and the cortisol level. Also, there was a correlation between low cortisol levels before treatment and good response to parent training.

## Discussion

The aim of this study was to evaluate the association of cortisol levels and disruptive behaviors in children and adolescents and also to assess and compare the response of both variables to intervention by parent training. The results of this study clarified that children with DBD who had lower basal cortisol levels had more severe disruptive behaviors and also a better response to parent training. Parent training is a suitable and effective psychotherapeutic method for behavioral modification in children with DBD. Findings of this study are in agreement with the results of some previous studies. Two similar studies<sup>30,31</sup> have shown a reverse correlation between cortisol level and impulsivity, substance abuse and violence. Other studies demonstrated the relationship between low basal salivary cortisol and aggression in boys with DBD<sup>11</sup> and also a lower cortisol level in adolescent with conduct disorder<sup>13</sup>. A reduced salivary cortisol in children with combined ADHD and ODD has been also emphasized on<sup>14</sup>. Again a negative association has been shown between cortisol levels and

antisocial symptoms in preadolescent boys<sup>17</sup>. In a 5-year longitudinal study on adolescent boys, a lower salivary cortisol level was detected in adolescents with more aggressive behaviors<sup>31</sup> and at last, in harmony with our findings, cortisol levels have been suggested to have a predictive value for severity of aggressive behaviors (11). Nevertheless, some other studies do not support the idea of relationship between basal cortisol levels and severity of disruptive behaviors<sup>7,18,27</sup>. Our study had some limitations such as lack of control group and the relatively small sample size. Another limitation of this study was lacks of follow-up retests to examine the stability of the findings over the time. In summary, low cortisol level may be considered as a predictive factor for severity of disruptive behaviors in children and adolescents with DBD and also, for a better response to potential interventions such as parent training. Longitudinal studies and controlled trials with larger sample sizes can be highly elucidating in this regard.

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