

# Association between Parent-Reported Executive Functions and Self-Reported Emotional Problems among Adolescent Offspring of Fathers with Alcohol-Dependence

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## Abstract

**Objectives** To compare the executive functions in adolescents of fathers with alcohol dependence (AOFADs) with a control group of adolescents without a paternal history of alcohol dependence and examine the association between executive functioning problems and behavioral and emotional problems.

**Materials and Methods** The study included 39 AOFADs and 45 adolescent offspring of fathers without a history of alcohol-use disorders, who were matched for age and sex. They were assessed using standardized measures of executive functions and emotional and behavioral problems.

**Statistical Analysis** A comparison was made between the two groups about the parental report of adolescents' executive functions and adolescents' self-reported emotional and behavioral problems. ANCOVA was performed to understand the covariance of educational and socio-economic status on executive functions. Correlation between executive functions, emotional and behavioral problems, and the duration of father's alcohol dependence was examined with Spearman's rho.

**Results** AOFAD group showed significant impairment on all subdomains of executive functions and emotional and behavioral disturbances ( $p < 0.01$ ) but not on the prosocial behavioral dimension ( $p < 0.01$ ). The group differences were independent of child's education and family income. Executive functional impairments positively correlated with psychopathology ( $p < 0.01$ ). Problems with executive functions and psychopathology correlated with the duration of the father's alcohol dependence.

## Keywords

- ▶ adolescents
- ▶ fathers with alcohol dependence
- ▶ executive functions
- ▶ behavioral problems
- ▶ emotional problems
- ▶ SDQ
- ▶ BRIEF

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**Conclusions** AOFADs are at risk for executive function impairments which in turn are strongly associated with emotional and behavioral problems. The association is independent of child's education and family economic status. The duration of alcohol dependence in fathers is associated with these problems. It has implications for targeted interventions for both adolescents and families.

## Introduction

Studies focusing on adults with alcohol dependence have found deficits in executive functions and reduced cortical activities in the related brain structures. These deficits are strongly correlated with behavioral disinhibition and substance-use behaviors.<sup>1,2</sup> As far as children are considered, studies have focused more on the impact of mother's alcohol use during pregnancy<sup>3,4</sup> and the impact of father's use of alcohol on child's wellbeing and family functioning.<sup>5,6</sup> There are few studies on adolescent offspring of fathers with alcohol dependence (AOFAD) though they are at a developmentally critical stage for independent adult roles and are highly vulnerable to harmful use of substances and stress-related disorders.<sup>7</sup>

### Executive Function Deficits in AOFAD

One of the initial studies in this area is by Wiers et al<sup>8</sup> has examined the effect of multigenerational alcoholism vis-à-vis childhood attention-deficit hyperactivity disorder and conduct disorder on the executive functions in 76 boys aged 7 to 11 years. The study found that parental alcohol use predicted selective attention deficits, which further mediated the executive functions. Subsequent studies consistently showed that executive functions are impaired in the children of fathers with alcohol-use disorders. For instance, a survey by Grekin et al<sup>9</sup> examined the association between parental alcohol use and the child's executive functioning in 816 adolescents (414 boys and 402 girls) whose mean age was 15 years 2 months (standard deviation [SD] 3.48 months). The children were assessed with Stroop Color Word Test and Wisconsin Card Sorting Test. Results indicate that the study group had significant impairments in executive functions attributable to paternal alcohol dependence. However, the impairments in executive function were evident only on the Stroop test. Similar data on the executive functions in children have been published from the developing countries as well. For example, a study from India<sup>10</sup> has examined the behavioral and cognitive problems among the children of fathers with and without alcohol dependence. The study used Malin's Intelligence Scale for Indian Children (MISIC) and Trail Making Test to assess the cognitive functions. The study revealed that the children of fathers with alcohol dependence have significant difficulties with frontal lobe functions, including deficits in executive functions. Although there is limited evidence, subsequent studies have found that executive functioning deficits seem to continue into the adulthood of AOFAD.<sup>11</sup> Given the lack of literature from the developing countries, it is essential to study the nature of executive deficits in AOFADs more extensively.

### Behavioral and Emotional Problems in AOFAD

A systematic review by West and Prinz<sup>12</sup> which focused on the studies published between 1975 and 1985 revealed diverse psychopathology, vulnerability to inevitable psychosocial adversities and dysfunctional family interactions in children of fathers with alcohol dependence. Subsequent studies have also supported that parental alcoholism is associated with a heightened incidence of psychopathology, behavioral disturbances, and occupational impairments in children. For instance, Barnow et al<sup>13</sup> examined the role of family loading of alcohol use in externalizing symptoms among 7 to 18 years old children. The results reveal a significantly positive correlation between children's attention and delinquent behavior and the number of first or second-degree relatives with alcohol-use disorders. The correlation was significant even after controlling for antisocial personality disorder and drug dependence in the parents. Thus, there is considerable evidence to suggest that executive functioning deficits besides family stress were strongly associated with various behavioral and emotional problems, including child delinquency in the context of parental alcohol-use disorders.<sup>9</sup>

A community-based longitudinal study by Keller et al<sup>14</sup> yielded results similar to the previous studies. Keller et al followed up families with a child in kindergarten ( $n = 235$ ) at two time-points. They found a direct effect of parental alcohol problems on both internalizing and externalizing problems in children through the mediation of destructive marital conflict and indirect effects of paternal drinking. Studies from developing countries have reported similar findings. A study from India revealed lower self-esteem and poor adjustment in AOFADs ( $n = 50$ ) when compared with the matched, reference controls, though the stress and vitiated domestic environment were attributed for the same.<sup>15</sup> Another study from India indicated that the children of alcohol-dependent parents have significant externalizing and internalizing problems, with girls having more problems than boys. However, the family environment is reportedly adverse for both boys and girls.<sup>16</sup> Another study from India<sup>17</sup> examined psychopathology and neuropsychological characteristics of 50 children with a paternal history of alcohol dependence compared with 50 children without such history. The study found that those with a paternal history have significant problems in both domains. The study did not elaborate on the nature of psychopathology in the study group. However, a potential limitation of this study is that it used Child Behavior Checklist as the single measure of psychopathology sans any clinical interviews and MISIC as

a measure of neuropsychological status even though it is not a robust measure. A study from an inpatient facility of a tertiary health care center in central India examined psychopathology in children of alcohol-dependent parents ( $n = 50$ ) and no-alcohol-dependent parents in the age range of 4 to 14 years.<sup>18</sup> The results indicate that the children of parents with alcohol dependence had marked levels of depression and anxiety but no significant issues related to behavioral problems, conduct disorder, psychotic symptoms, physical illness, emotional problems, and somatization. Another study from India also revealed that the children of parents with alcohol dependence experience a higher rate of anxiety, depression, and low self-esteem than children of non-alcoholic parents.<sup>19</sup> Similar trends were noted from other developing countries. For instance, a study from Morocco indicates that AOFADs show significantly high levels of psychological distress, especially symptoms of somatization, hostility, and anxiety.<sup>20</sup> Overall these findings suggest that the children and adolescent offspring of parents with alcohol dependence can have significant levels of both internalizing and externalizing problems.<sup>10,13,16,21–24</sup> A few studies have noted that the behavior problems varied with the gender of the children, with externalizing problems more in boys and internalizing problems more in girls.<sup>6,20</sup> But there is also evidence to suggest that gender is an essential factor only at certain age levels, particularly during pre-adolescence.<sup>25,26</sup>

In summary, a few studies have identified the importance of executive dysfunction in psychopathology in children of alcohol-dependent parents.<sup>2,8</sup> Moreover, the nature of psychopathology can vary with a child's gender and family variables. However, prior Indian literature on executive function impairment among the offspring of alcohol-dependent fathers has been sparse and sporadic. Furthermore, previous studies have involved a narrower age range or have only assessed specific elements of executive functioning.

## Objective

Our objective was to compare the executive functions in a sample of AOFADs with a control group of adolescents without a paternal history of alcohol dependence and examine the association between executive functioning problems and behavioral and emotional problems.

Based on the current evidence albeit predominantly from the adult population, the hypotheses formulated were as follows. (1) AOFADs will have significant executive impairment, when compared with the control group (adolescent children with no history of paternal alcohol dependence). (2) There will be a significant correlation between the executive functioning problems and the behavioral and emotional problems, among the AOFADs.

## Methodology

### Participants

The sample consisted of two groups of adolescents aged 10 to 19 years. The age range was decided as per the World Health

**Table 1** Characteristics of the participants

	AOFADs ( $n = 39$ )	Control group ( $n = 45$ )	$U/\chi^2$
Age in years (mean, SD)	13.53 (2.67)	13.93 (1.67)	816
Sex			
Male	12 (31%)	17 (38%)	0.45
Female	27 (69%)	28 (62%)	
Education			
Primary	14 (36%)	3 (7%)	11.06 <sup>a</sup>
High-school education and above	25 (64%)	42 (93%)	
Family income in rupees (mean, SD)	8,910.3 (11687)	13,433 (9373.3)	406 <sup>a</sup>
Duration of alcohol dependence in father (in y)	10.20 (7.14)	Not applicable	–

Abbreviations: AOFAD, adolescents of fathers with alcohol dependence; SD, standard deviation.

<sup>a</sup> $p < 0.01$ .

Organization.<sup>27</sup> Group one included 39 AOFADs with the International Classification of Diseases -10 diagnosis of alcohol dependence in fathers. Group two had 45 adolescents without a history of alcohol dependence in fathers (hereafter, control group). The exclusion criteria included low body mass index (BMI), history of seizures, head injury, unconsciousness, and any major health problems in the last 2 years were. A few participants were recruited from schools ( $n = 53$ , 63%) and the community ( $n = 13$ , 16%) through the snowballing method. A few AOFADs were recruited by purposive sampling when their fathers came to the study center for mental health services for alcohol use ( $n = 18$ , 21%). Because of the differences in the sampling technique used, the control group cannot be expected to be exactly equal to AOFADs. For more detail, see ► **Table 1** that presented the sociodemographic characteristics of both groups.

## Measures

### Executive Functions

Behavior Rating Inventory of Executive Function, Parent Form, Second Edition (BRIEF) was used to measure the executive functions.<sup>28</sup> This scale consists of 79 items which are rated on a three-point Likert scale. The BRIEF assesses executive functions, which compose three indexes: the Behavior Regulation Index (BRI), Emotion Regulation Index (ERI), Cognitive Regulation Index (CRI), and an overall summary score, the Global Executive Composite (GEC). Higher scores represent higher dysfunction in all the areas. The BRIEF also classifies executive function impairment into three levels: mildly elevated, potentially clinically elevated, and clinically elevated. The BRIEF has been used in prior studies in India.<sup>29</sup>

### Behavioral and Emotional Problems

The Strengths and Difficulties Questionnaire (SDQ) was used to measure this domain.<sup>30</sup> This scale assesses the behavioral and emotional problems and prosocial behaviors, comprising of 25 items that are rated on a three-point scale. SDQ yields scores on five scales: emotional symptoms, conduct problems, hyperactivity inattention, peer problems, and prosocial behavior. Sum of all items except prosocial behavior scale items constitutes the total difficulties scale. Each scale has cutoffs to understand the clinical significance of the scores. Except for the prosocial behavior scale, higher scores on SDQ scales indicate more problems in that domain. SDQ has three forms—parents', teachers', and self. We have used the self-report form in this study.

### Procedure

The study was approved by the Institute's Ethics Committee of the National Institute of Mental Health and Neurosciences (NIMHANS). Written informed assent from a child and consent from a parent were obtained if an adolescent was under 18 years of age. In the case of AOFADs recruited from the clinic, alcohol-use history in fathers was noted from the case file. Conversely, in the case of adolescents recruited from the schools and community, the history of alcohol dependence in the father was confirmed by interviewing the fathers and/or the mothers of the adolescents. Each adolescent who participated in the study was further interviewed individually to obtain socio-demographic information. The adolescent's BMI was assessed and interpreted as per the revised growth charts for Indian children.<sup>31</sup> Information regarding the health of the adolescents was obtained from their mothers, and it was considered nil significant if the adolescent did not require a hospital visit in the last 2 years. BRIEF-P and SDQ were administered individually by a trained project staff by directly interviewing the mothers.

### Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences for Windows version 24. Group differences in executive function impairment (AOFADs and control group) were analyzed using the chi-square test and *t*-test/Mann-Whitney *U*. Spearman's and Pearson's correlation coefficients were computed to examine the associations among selected clinical variables, BRIEF scores, and SDQ scores. Analysis of covariance (ANCOVA) was done to determine the differences in the impairment of executive functions after controlling for income and education, as the two groups differed significantly on these two variables.

### Results

► **Table 1** indicates that both groups were statistically matched for age and gender. But, AOFADs had lower levels of education ( $\chi^2 = 11.06$ ;  $p < 0.01$ ) and economic status ( $U = 406$ ;  $p < 0.01$ ) than the control group.

► **Table 2** indicates that AOFADs had significantly higher scores on BRIEF than the control group in all domains ( $p < 0.001$ ).

**Table 2** The mean scores of the two groups on BRIEF scales

Variables	AOFADs (n = 39) M(SD)	Control group (n = 45) M(SD)	t/U
Global Executive Composite	59.07 (7.68)	44.73 (6.22)	131.0 <sup>a</sup>
Behavior Regulation Index	56.28 (9.48)	44.35 (7.00)	204.50 <sup>a</sup>
Inhibit	57.02 (9.84)	44.6 (7.17)	233.50 <sup>a</sup>
Self-monitor	54.02 (9.46)	45.02 (6.55)	323.0 <sup>a</sup>
Emotion Regulation Index	64.17 (9.05)	48.06 (5.75)	114.0 <sup>a</sup>
Shift	61.69 (9.93)	48.08 (6.50)	232.50 <sup>a</sup>
Emotional control	62.17 (9.53)	48.75 (5.89)	229.0 <sup>a</sup>
Cognitive Regulation Index	57.30 (8.09)	44.77 (8.09)	196.0 <sup>a</sup>
Initiate	55.30 (8.37)	47.57 (5.29)	398.0 <sup>a</sup>
Working memory	60.61 (10.26)	46.4 (8.97)	257.0 <sup>a</sup>
Plan/organize	58.66 (8.25)	42.53 (6.85)	132.50 <sup>a</sup>
Task monitor	53.87 (8.31)	43.11 (6.20)	264.0 <sup>a</sup>
Organization of materials	53.15 (9.86)	45.42 (4.86)	452.50 <sup>a</sup>

Abbreviations: AOFAD, adolescents of fathers with alcohol dependence; BRIEF, Behavior Rating Inventory of Executive Function; M, mean; SD, standard deviation.

<sup>a</sup> $p < 0.01$ .

► **Table 3** indicates that AOFADs had significantly more elevated scores on SDQ's total difficulties ( $U = 240.50$ ;  $p < 0.01$ ), emotional problems ( $U = 392.50$ ;  $p < 0.01$ ), conduct problems ( $U = 445.0$ ;  $p < 0.01$ ), hyperactivity ( $U = 268.50$ ;  $p < 0.01$ ), and peer problems ( $U = 389.0$ ;  $p < 0.01$ ) subscales. However, no significant group differences were found on the prosocial behavior scale ( $U = 781.50$ ;  $p = 0.37$ ).

► **Table 4** indicates that the duration of alcohol dependence in fathers was significantly correlated with all domains of the BRIEF and three domains of SDQ. The BRIEF domain results are as follows: GEC score ( $\rho = 0.77$ ;  $p < 0.001$ ), BRI ( $\rho = 0.68$ ;  $p < 0.001$ ), ERI ( $\rho = 0.48$ ;  $p < 0.001$ ), and CRI ( $\rho = 0.76$ ;  $p < 0.001$ ). The correlation coefficients of the SDQ domains are as follows: total difficulties ( $\rho = 0.31$ ;  $p < 0.05$ ), emotional problems ( $\rho = 0.39$ ;  $p < 0.05$ ), conduct problems ( $\rho = 0.19$ ; not significant), hyperactivity ( $\rho = 0.51$ ;  $p < 0.001$ ), peer problems ( $\rho = -0.13$ ; not significant), and prosocial behaviors ( $\rho = -0.21$ ; not significant).

Since AOFADs were predominantly from lower educational and economic strata, we wanted to rule out the impact of these two variables on executive functioning. Accordingly, ANCOVA was used to determine the differences in executive

**Table 3** The group differences with respect to the SDQ scale

Variables	AOFADs (n = 39) M (SD)	Control group (n = 45) M (SD)	U
Total difficulties score	25.87 (4.89)	17.51 (5.98)	240.50 <sup>a</sup>
Emotional problems score	6.48 (2.45)	3.48 (2.76)	392.50 <sup>a</sup>
Conduct problems score	3.02 (1.59)	1.66 (1.60)	445.0 <sup>a</sup>
Hyperactivity score	4.71 (1.93)	2.22 (1.66)	268.50 <sup>a</sup>
Peer problems score	3.41 (1.64)	1.68 (1.81)	389.0 <sup>a</sup>
Prosocial score	8.23 (1.67)	8.51 (1.67)	781.50

Abbreviation: AOFAD, adolescents of fathers with alcohol dependence; M, mean; SD, standard deviation.  
<sup>a</sup> $p < 0.001$ .

**Table 4** Spearman’s correlation between the duration of alcohol dependence in fathers and the BRIEF and SDQ scores in their offspring

BRIEF scores	$\rho$	SDQ scores	$\rho$
Global Executive Composite score	0.77 <sup>b</sup>	Total difficulties	0.31 <sup>a</sup>
Behavior Regulation Index	0.68 <sup>b</sup>	Emotional problems	0.39 <sup>a</sup>
Emotion Regulation Index	0.48 <sup>b</sup>	Conduct problems	0.19
Cognitive Regulation Index	0.76 <sup>b</sup>	Hyperactivity	0.51 <sup>b</sup>
		Peer problems	-0.13
		Prosocial behavior	-0.21

Abbreviations: BRIEF, Behavior Rating Inventory of Executive Function; SDQ, The Strengths and Difficulties Questionnaire.  
<sup>a</sup> $p < 0.05$ .  
<sup>b</sup> $p < 0.001$ .

function scores (GEC, BRI, ERI, and CRI) between groups (AOFAD and control group) after controlling for family income and child’s education. Results indicated that AOFADs had significantly higher score than the control groups even after controlling for income and education (GEC-F = 35.92,  $p < 0.01$ ; BRI-F = 18.97,  $p < 0.01$ ; CRI-F = 19.88,  $p < 0.01$ ; ERI-F = 37.18,  $p < 0.01$ ). A separate analysis indicated that AOFADs did not significantly differ in executive functions and psychopathology in reference to their gender.

**Correlation between BRIEF and SDQ Scores in AOFADs**

The mean SDQ total difficulties score was 25.87 (SD 4.89; range = 13.0–35.0), and the mean GEC score was 59.07 (SD = 7.68; range = 45.0–77.0). The GEC score in the AOFADs (n = 39) positively correlated with SDQ’s total difficulties

score ( $r = 0.49$ ,  $p < 0.01$ ), as well two of the sub-domains, viz. emotional problems score ( $r = 0.48$ ,  $p < 0.01$ ) and hyperactivity score ( $r = 0.58$ ,  $p < 0.01$ ). The CRI ( $r = 0.53$ ,  $p < 0.01$ ) and BRI ( $r = 0.31$ ,  $p < 0.05$ ) positively correlated with the SDQ total difficulties score.

**Discussion**

Children with a paternal history of alcohol dependence are reported to be at risk for cognitive deficits and behavioral disturbances because of direct and indirect effects of alcohol use in fathers. But there are few studies on AOFADs who are developmentally at a critical stage of transition into adulthood. In this context, the present study examined the status of executive functions in AOFADs as reported by their parents and its correlation with behavioral and emotional problems in AOFADs.

**Nature of Executive Functioning Deficits**

Children with the father having alcohol dependence were found to have maturational lag and executive function deficits.<sup>10,16,22</sup> However, many studies, particularly those that focused on adults, have primarily described inhibition impairment.<sup>26,32</sup> The current study reveals that AOFADs can have significant difficulties in various executive functions such as inhibiting impotent responses, poor self-monitoring, shifting focus to adaptive responses, emotional control, and overall organizational skills. Thus, the problems seem to encompass the core three dimensions of executive functions, viz., behavioral, emotional, and cognitive capacities and the problems seem to be clinically significant. These findings are similar to the emerging evidence noted in adults with alcohol dependence that impairment encompasses each subcomponent of executive functions.<sup>1</sup>

**Nature of Emotional and Behavioral Problems**

SDQ scores indicate that AOFADs experience significantly more emotional and behavioral problems than the control group. The issues ranged from emotional problems, conduct problems, and hyperactivity to interpersonal difficulties with peers. However, AOFADs did not differ from the control group in prosocial behaviors. These findings are supported by the existing literature that internalizing disorders,<sup>26,33</sup> conduct disorders,<sup>10,33,34</sup> peer problems,<sup>20</sup> and low self-esteem<sup>19</sup> are widely prevalent in AOFADs. The majority of the previous studies indicate that externalizing disorders are more common than internalizing disorders in children of alcohol-dependent parents.<sup>10,22</sup> However, the current study suggests that both internalizing and externalizing problems are prevalent in AOFADs and they exist without any impairments in prosocial behaviors. In light of these findings, it is necessary to examine if the group differences were due to gender differences. A few studies that have examined gender differences have reported externalizing problems are found more among boys and internalizing problems are more among girls.<sup>6,16</sup> However, the current study did not find any gender differences in behavioral and emotional problems as measured by SDQ. This finding corroborates with the

study by Furtado et al<sup>35</sup> that gender differences in psychopathology may not be evident in adolescents and older groups.

### Father's Alcohol Dependence and Child's Executive Dysfunctions and Behavioral Pathology

The current study supports the previous studies that the mean number of years of alcohol dependence in fathers positively correlated with children's executive functional impairments and psychopathology.<sup>36</sup> For instance, Grekin et al<sup>9</sup> found that paternal alcohol-use disorders are associated with child executive functioning and family stress, which may lead to externalizing problems such as child delinquency. Insights into the link between executive functions and psychopathology also come from studies focusing on general physical conditions. For instance, a survey of adolescents with coronary heart diseases indicates that executive function problems can disrupt the application of critical adaptive coping skills, resulting in poor coping and more significant emotional distress.<sup>37</sup>

Some studies found that fathers' alcohol dependence and children's psychopathology are not consistent when other variables are factored.<sup>2</sup> Conversely, a few studies indicate that the association is robust even after controlling for important variables such as children's age and gender.<sup>13,14,16,17,26,38</sup> However, the current study reveals a strong association between executive functions and psychopathology in AOFADs even after controlling for family income and AOFADs' education. Therefore, this study suggests that executive dysfunctions and paternal alcohol dependence strongly correlated with both internalizing and externalizing problems in AOFADs. Interestingly, the AOFADs did not differ from their peers in interpersonal skills and prosocial behaviors. Thus, it indicates that AOFADs can have well-preserved interpersonal or social skills even in the backdrop of emotional and behavioral problems. These findings have an important implication for intervention—strengths coexist with behavioral disturbances and the former can be strengthened to the child's advantage.

There are specific limitations to this study. The adolescents' executive functions were reported by parents, while the emotional and behavioral problems were self-reported by the adolescents. Hence, reporting biases cannot be ruled out. More importantly, robust methods such as clinical interviews were not employed to understand the psychopathology in AOFADs. Parental psychopathology was not examined or controlled in the study.

### Conclusion

This study indicates that AOFADs are reported to have a wide range of executive function impairments associated with various emotional and behavioral problems. The correlation seems to be independent of family income and AOFADs education level. The duration of alcohol dependence in fathers appears to be an essential factor in this association. Therefore, the findings indicate that it is crucial to pay special attention to children whose parents have alcohol depen-

dence. Early intervention during the pre-adolescence period may be necessary to minimize or prevent functional impairments and behavioral problems.

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### Conflict of Interest

None declared.

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