



## Behavioral Inhibition and Cognitive Emotion Regulation in Attention Deficit Hyperactivity Disorder

### KEYWORDS

Attention Deficit Hyperactivity Disorder, Behavioral Inhibition, Cognitive Emotion Regulation.

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### ABSTRACT

*Attention Deficit Hyperactivity Disorder (ADHD) is a developmental impairment of complex range of executive functions among which cognitive emotion regulation and behavioral inhibition plays a significant role in regulating their behaviors. The ADHD children (N=20) selected as study group and age, education matched Normal group (N=20) were selected to the control group. Cognitive emotion regulation and Behavioral inhibition was measured. The ADHD group performed poorly than the control group on the tests of behavioral inhibition. No significant differences were found between the groups on cognitive emotion regulation. However, ADHD group scored high on less adaptive coping strategies such as increased rumination, catastrophisation, and other blame. The cognitive emotion regulation ability of the child facilitated by behavior inhibition and executive function abilities of the child, which regulate and moderate their coping strategies as adaptive or less adaptive.*

### Introduction

Children with Attention Deficit Hyperactivity Disorder (ADHD) have significant difficulty in controlling their impulses and regulating their activity, attention, and social interactions to a degree consistent with relevant age and culture norms. This leads to their being frequently in trouble with adults and unpopular with peers. They under achieve at school or do not achieve at the level expected for their intelligence and most have learning difficulties.

ADHD children shows characteristics such as fails to give close attention to details or makes careless mistakes in schoolwork, or other activities, often has difficulty sustaining attention in tasks or play activities, often does not seem to listen when spoken directly, often does not follow through instructions and fails to finish school work, chores, or duties in the workplace, often has difficulty in organizing tasks that require sustained mental effort, often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books or tools), is often easily distracted by extraneous stimuli, is often forgetful in daily activities (APA, 2000).

The ADHD symptoms are present before the age 7 years in most of the clinical population. Hyperactive Impulsive (HI) type of ADHD considered as single dimension of behavior. ADHD children are unable to bridle their immediate reactions or to think before they act. Impulsivity in them may be cognitive or behavioral. Cognitive impulsivity refers to their hurried thinking, disorganization and the need for supervision. Behavioral impulsivity refers to their acting without considering the consequences of the actions (Reznick, 1989).

ADHD is often associated with dysregulation of affect, in addition to the hallmark dysregulation of activity, speech and activities of daily living. They have poor sense of time and understanding what is appropriate and difficulty with appropriate social performance even when the skill is established (Sandberg, 1996). These features are secondary to the deficits in self-regulation (Barkely, 1989; Jaap, 2010). The self-regulation deficits are associated with behavior inhibition deficits in ADHD

Behavioral inhibition is "the tendency to display an initial period of inhibition of speech, play, associated with retreat to a target of attachment, when the child encounters an unfamiliar/challenging environment" (Barkley & Ullman, 1975). Behavioral inhibition deficit is a neurological dysfunction (Barkely, 1997) and is linked to four executive functions

that appear to depend on it for their effective organization such as emotional regulation, working memory, internalization of speech and reconstitution. The executive functions are higher order cognitive capacities that evident in activities like decision-making, planning and social conduct. Literature shows primarily in the prefrontal region, which has solid reciprocal connections with the other cortical sub cortical and cerebellar regions (Baumeister & Vohs, 2005).

Emotion regulation is an ongoing process of responding to environmental situation with emotions that are both socially acceptable and context-appropriate for a given situation (Cole, Michel, & Teti, 1994). Cognitive emotion regulation involves generating, maintaining, decreasing or increasing either positive emotions or negative emotions. The cognitive emotional regulation plays a significant role in regulating appropriate behavior. It is major dimension influence the behavior of ADHD children regulating what they think (cognitive) versus what they do (behavioral).

The nature and extent of influence of these dimensions on their behavior will be helpful in management of ADHD. The purpose of the study was to examine the nature of relationship between behavioral inhibition and cognitive emotion regulation in ADHD children. It was hypothesized that compared to non-ADHD peers, those with ADHD would not be able to inhibit their behavior or regulate their emotion properly as stated by Walcott and Landau (2004). Thus, ADHD children shows poor emotion regulation and behavior inhibition

### Method

#### Participants & Tools

The participants were recruited from the outpatient department of psychiatry and clinical psychology department of Kasturba Hospital, Manipal University. The patients had been diagnosed clinically by consultants in charge. The patients who were referred for the study were screened on MINI Kid (International Neuropsychiatry Interview for children and adolescent by Sheehan et.al., 1998) and once they meet the cut of 15 on Connors Abbreviated Rating Scale (CARS, Oberoi & Kapur, 1995) and children are able to read write English, Kannada or Malayalam language were selected for the study. Forty boys between the ages of 9 and 15 participated in the study; 20 boys were identified as ADHD (all children who met diagnostic criteria for Hyperactive-Impulsive or combined type) and 20 were non- ADHD comparison boys. Non-ADHD comparison children, free of special-education

diagnoses and medication status and age matched with ADHD group. None of the participants' parents reported any evidence of pervasive developmental disorder, mental retardation, Tourette's syndrome, seizure disorder, or any other known neurological disorder.

Purposive sampling was employed to select participants for the study. The study design was cross-sectional case control. Table 1 shows analysis of demographics indicates there is no significant difference between ADHD and Normal group on age and education which ensures the matched sample in both group.

Table 1: Comparison between ADHD and Normal group on demographic variables

Demographics	Group	Median (IQR)	U	P
Age	ADHD	13 (9, 14)	165	0.34
	Normal	14 (10, 15)		
Education	ADHD	5 (4, 9)	144	0.13
	Normal	6(5, 10)		

Selected children were administered Cognitive Emotion Regulation Scale (CERQ, Garnevski & Kraiji, 2007) to measure the emotion regulation of the child. It is a self-report questionnaire consisting of 36 items and consists of 9 subscales. Versions are available for subjects below 12 years (CERQ-k) and above 12 years. It is a five point scale ranging from 1 to 5. Alpha coefficients of the various subscales of CERQ across the diverse population ranged from 0.68 to 0.80. The test-retest correlations range between 0.48 and 0.65. To measure behavioral inhibition of the children administered Stroop neuropsychology test.

## Results

We examined whether any differences in cognitive emotional regulation between ADHD and Non- ADHD children. Investigators employed Man-Whitney U test to calculate the mean differences. The result indicated that there is no significant difference between ADHD and Normal group on cognitive emotional regulation. Table 2 shows the mean differences between ADHD and normal group on CERQ subscales

Table 2: Comparison between ADHD and Normal group on cognitive emotional regulation

CERQ	Group	Median (IQR)	U	P
Self-blame	ADHD	8 (5, 12)	171	0.445
	Normal	8 (7, 11)		
Acceptance	ADHD	8 (6, 12)	173	0.478
	Normal	9 (7, 12)		
Rumination	ADHD	9.5 (6, 13)	173.5	0.478
	Normal	8.5 (6, 12)		
Positive Refocusing	ADHD	12 (8, 15)	189	0.779
	Normal	11.5 (9, 13)		
Refocus on planning	ADHD	12.5 (8, 15)	185	0.698
	Normal	12 (11, 14)		
Positive reappraisal	ADHD	10.5 (8, 13)	196.5	0.925
	Normal	10.5 (8, 13)		
Putting into perspective	ADHD	9 (7, 12)	191.5	0.820
	Normal	8 (6, 12)		
Catastrophizing	ADHD	8.5 (5, 12)	153.5	0.211
	Normal	6 (5, 9)		
Other blame	ADHD	8.5 (6, 13)	135.5	0.081
	Normal	7.5 (4, 8)		

As table 2 shows, ADHD children are not significantly differ in terms of cognitive and emotional coping strategies when compared to normal group. Both groups of children are able to employ the appropriate coping strategies, which help them to manage various situations effectively. However, the analysis reveals that ADHD children are tend to use catastrophizing and rumination as coping strategies when compared to normal control group. Table 3 shows the comparison between ADHD and normal group on behavioral inhibition.

Table 3: Comparison between ADHD and Normal group on behavioral inhibition

Variables	Groups	Median (IQR)	U	P
Stoop effects	ADHD	152 (103, 190)	52	<.001
	Normal	67 (41, 86)		
Stroop errors	ADHD	17.5 (13, 24)	70	<.001
	Normal	5 (2, 7)		

## IQR-Inter Quartile range

As Table 3 shows, behavior inhibition ability of the ADHD children is significantly low compared to normal group. The behavior inhibition of ADHD and normal group in the present study was derived from Stroop effects (Mann Whitney U = 52,  $p < 0.001$ ) and Stroop errors (Mann Whitney U = 70,  $p < 0.001$ ). As literature reported ADHD children were unable to control or suppress their behavior, especially HI type of ADHD children are more vulnerable to behavior inhibition deficit. The current study reveals that the relationship between behavior inhibition and cognitive emotion regulation was not significant (spearman rho = -0.082 & -0.187 in stroop effect and error). Similarly, cognitive emotion regulation sub scales were not showing significant relationship with stroop effect and errors.

## Discussion

The objective of the study was to find out the degree of relationship between behavior inhibition and cognitive emotion regulation in ADHD children in comparison to normal group. Previous research study finding reveals the behavior inhibition deficits in ADHD children and which is linked to executive function ability of the ADHD child (Passarotti et.al., 2010; Luman et.al., 2009). The current study was to investigate the influence of these deficits in generating and employ cognitive emotion coping strategies in ADHD children. As per the literature findings behavior inhibition deficits may hinder to apply appropriate coping strategies in various situations.

Present research shows that there are significant differences between ADHD and normal group in behavior inhibition. ADHD children shows high behavior inhibition deficit. Barkely (1997) reported that behavioral inhibition is the result of neurological dysfunction in the prefrontal regions of the brain. Behavior inhibition requires the suppression of prepotent motor responses. It requires the activation of a circuit linking basal ganglia and Orbito Frontal Cortex. It appears as a temperamental predisposition in childhood. In ADHD, the Behavior inhibition system is under active and which can lead to increased emotional reactivity to emotionally charged immediate events. They are generally shows decreased goal directed behavior, increased depends on external sources and difficulties restricting their behavior in conformance with instruction to do so (Barkley and Ullman, 1975).

Current research reveals that there is no relationship between behavior inhibition and cognitive emotion regulation. Similarly, ADHD children were able to use their cognitive coping strategies like normal group. The findings are contradicted with the existing research report (e.g. Barkely, 1989). ADHD children are able to perform cognitive emotion coping strategies such as acceptance, positive refocusing, refocus on planning, positive reappraisal, and putting into perspective equally with normal group. These cognitive activities help the children to regulate their emotion effectively. However, ADHD children were involved in other coping strategies such as rumination, catastrophizing, self-blame and other blame, which was relatively high compared to control group. It indicates that ADHD children were able to regulate their emotions irrespective of their behavior inhibition deficits. They could use above cognitive strategies to regulate their emotion in relation to negative and stressful life events.

As reported in the literature behavior inhibition deficits are closely associated with executive functioning (Scheres et. al., 2008). Behavior inhibition deficits reported in the present study was not enough to produce impairment in executive function tasks and hinder the cognitive processes of the

children. Thus, current research gives an insight towards the treatment of ADHD children. Operation of appropriate cognitive enhancement tasks may preserve the cognitive processes in ADHD children and reduce the cognitive deficits due to their disorder.

In conclusion, the present study failed to establish a robust relationship between behavior inhibition and cognitive emo-

tion regulation. Behavior inhibition deficits alone may not delay cognitive processing and employ appropriate coping strategies. The study included only children with no comorbid psychiatric disorder. As a limitation, low sample size of the study limits the generalizability of the results. Gender was restricted only to boys in the study.

## REFERENCE

- American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorder (4th ed., text rev.). Washington, DC: Author. | Barkely, R.A. & Ulman. (1975). The executive functions and ADHD. *Journal of American Academy of child and adolescent psychiatry*, 39, 1064-1068. | Barkely, R.A. (1989). *Attention Deficit Hyperactivity Disorder*. New Jersey Human Press Inc. | Barkely, R.A. (1997). Behavioral Inhibition, Sustained Attention and Executive Functions: Constructing a Unifying Theory of ADHD. *Psychological Bulletin*, 121 (1), 65-94. | Baumeister, R.F. & Vohs, K.D. (2005). *Handbook of self regulation: Research, theor and applications*. New York: Sergeant Publishes. | Cole, P.M., Michel, M.K. & Teti, L.O. (1994). The development of emotion regulation and dysregulation: a clinical perspective. *Monogr Soc Child Dev*, 59 (2-3), 73-100. | Garnefski, N., Kraaij, V., & Spinhoven, P. (2002). CERQ: Manual for the use of the Cognitive Emotiona Regulation Questionnaire. Netherlands: DATEC. | Jaap, M. (2010). State Regulation and Attention deficit Hyperactivity Disorder. In Gozal, D & Molfese (Ed.), *Attention Deficit Hyperactivity Disorder* (pp. 179-182). New Jersey: Humana Press Inc. | Luman, M., Noesel, J.P., Papanikolau, A., Scheffer, J.V., Veugelers, D., Sergeant, J.V., & Oosterlaan, J. (2009). Inhibition, Reinforcement Sensitivity and Temporal information Processing in ADHD + ODD: Evidence of a separate entity? *Journal of Abnormal Child Psychology*, 37(8), 1123-1135. | Passarotti, A.M., Sweeney, J.A., & Pavuluria, M.N. (2010). Neural correlates of response inhibition in Pediatric Bipolar Disorder and Attention Deficit Hyperactivity Disorder. *Psychiatric Research*, 181 (1), 36-43. | Reznick, J. S. (1989). *Perspective on behavioral inhibition*. USA: Chicago Press Ltd. | Sandberg, S. (1996). *Hyperactivity and disorders of childhood*. New York: Cambridge University Press. | Scheres, A., Oosterlaan, J. & Sergeant, J.A. (2001). Response Execution and Inhibition in children with AD/HD and other Disruptive Disorder: The Role of Behavioral activation. *Journal of Child Psychology and Psychiatry*, 42 (3), 347-357. | Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Amorim, P., Janavas, J., Weiller, E., Herqueta, T. & Dunbar, G.C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10, 59, 22-33. | Walcott, C.M. & Landau, S. (2004). The relation between disinhibition and emotion regulation in boys with attention deficit hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychiatry*, 33(4), 772-782.