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Research paper

The Effect of Integrated Training of Executive Functions Hot and Cool on Emotion Regulation in Children with ADHD

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Abstract

Emotional dysfunction in children with ADHD jeopardizes their adaptation. The present study aimed to investigate the effect of integrated training of executive functions hot and cool on emotion regulation in children with ADHD. This research was a quasi-experimental study with pretest-posttest control group design. The statistical population of the present study consisted of all 9 to 12-year-old children with ADHD in Rasht. Among them,26 children were selected through convenience sampling. They were then equally assigned to two control and experiment groups. The children in the experimental group and their mothers each received the intervention program in 10 sessions. The instruments used included demographic questionnaire, Canners Rate Scale, Emotion Regulation Checklist. Data were analyzed using analysis of covariance. the results showed that Integrated Training of Executive Functions improved emotion regulation in children with ADHD. Therefore, the use of multidimensional interventions is recommended.

Keywords: ADHD, children, emotion regulation, hot and cool executive functions, parent.

Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a psychiatric disorder that affects children's functioning. In diagnosing the symptoms of this disorder, researchers paid attention to three signs of inattention, hyperactivity and impulsivity (Magnus, et al., 2021). However, emotional symptoms are of the main characteristics of these children (Beheshti, et al., 2020). There is a clear link between emotion regulation strategies and executive functions (EFs) in children with ADHD (Predescu, et al., 2020). Some also stated that the problems related to recognizing facial emotions are due to executive failures in these people (Sánchez, et al., 2019). EFs have two dimensions: the cool dimension, which refers to the cognitive aspects such as metacognition, cognitive flexibility, inhibition, working memory, and problem solving; and the hot dimension, which refers to the emotional aspects of cognition, such as behavior regulation, emotions, and decision making. Both aspects need to be integrated; without such development, emotional dysregulation will occur (Nemeth & Chustz, 2020). Research (Xie, et al., 2021; Xiu, et al., 2018) has shown that EF training can improve the symptoms of children with ADHD. It has also been proven that parental involvement is important in the treatment of children with ADHD (DuPaul, et al., 2018). Previous research

has relied more on the cool dimension of Executive functions and ignored the hot dimension, while both dimensions are essential for optimal performance. Most of these interventions have been child-centered and the simultaneous parent - child interventions were limited. As a result, due to the research gap and the need for simultaneous interventions at different levels, the present study was conducted to investigate the effect of integrated training of hot and cool EFs on emotion regulation in children with ADHD.

Method

This research was a quasi-experimental study with pretest-posttest control group design. The statistical population of the present study consisted of all 9 to 12-year-old children with ADHD in Rasht. The sample consisted of 26 children with ADHD who were selected through convenience sampling and equally assigned to the control and experimental groups. The children and their mothers in the experimental group each received the intervention program in 10 sessions. The instruments used included demographic questionnaire, canners rate scale, emotion regulation checklist.

The Canners Rate Scale includes 48 items and subscales of conduct problems, social problems, anxiety-shyness, and psychosomatic. The 4 - point Likert scale ranges from 0 (rarely) to 3 (almost always). In the study of Lin, et al. (2019) Cronbach's alpha for total score was 0.932. validity and reliability were appropriate. In this study, Cronbach's alpha was 0.71.

The Emotion Regulation Checklist was created in 1997 by Shields & Cicchetti. The items of ERC are rated on a 4-point Likert scale (1 = never and 4 = always). It consists of 22 items and two subscales of lability/negativity and emotion regulation. In the study of Milojevich, et al. (2020), Cronbach's alpha was reported to be 0.87 and 0.82, respectively. Validity and reliability were appropriate. In this study, Cronbach's alpha for lability/negativity and emotion regulation was 0.73 and 0.77 respectively.

Results

The results of the multivariate analysis of covariance related to emotion regulation components in the experimental and control groups showed that the F value of emotion regulation components (F = 121.26) is significant at the 0.01 level ($p<0.01$). Therefore, there is a significant difference between the experimental and control groups in terms of emotion regulation components in the post-test.

Table 1. Results of analysis of variance of the difference between the experimental group and the control group in the components of emotion regulation

Index of components	SS Trial	SS Error	MS Trial	MS Error	F	P	Effect size	Statistical power
Emotional lability/negativity	157.82	24.05	157.82	1.09	144.34	0.001	0.868	1
Emotion regulation	30.76	21.24	30.76	0.96	31.86	0.001	0.592	1

According to Table 1, the F - value is significant for the lability/negativity component (144.366) and emotion regulation (31.859) at the 0.01 level (P <0.01). Moreover, there is a significant difference between the experimental and control groups in these components. To investigate whether the mean of the posttest scores is higher than the mean of the pretest in the emotion regulation components, Bonferroni correction was used. In lability/negativity component, the mean of the experimental group was 33.979, the mean of the control group was 38.944, and the mean difference between the two groups was -4.965. In the emotion regulation component, the mean of the experimental group was 10.596, the mean of the control group was 8.404, and the difference between the mean of these two groups was 2.192, which was significant at the 0.01 level (P <0.01). Therefore, the integrated program of EFs training reduces the component of lability/negativity and increases the component of emotion regulation in these children.

Discussion and Conclusion

The results showed that integrated training of EFs improved the emotional regulation of the experimental group. Due to the fact that children with ADHD have problems in both the cool and hot dimensions of EFs, considering both dimensions in the treatment could have positive effects. Parental involvement has also increased the effectiveness of treatment. This study tried to provide a more comprehensive program by considering a multidimensional approach. This study was performed in children with ADHD aged 9 to 12 years, so caution should be exercised in generalizing to other age groups. Due to problems caused by Covid - 19 conditions, it was not possible to perform a follow - up. It is suggested that follow-up be performed in the future research, and that the effectiveness of this treatment be compared with other interventions.

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Conflicts of interest

The authors declare no conflict of interest for this study.