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EFFECT OF MINDFULNESS-BASED EMOTIONAL TRAINING ON ANXIETY AND SELF-REGULATION IN ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

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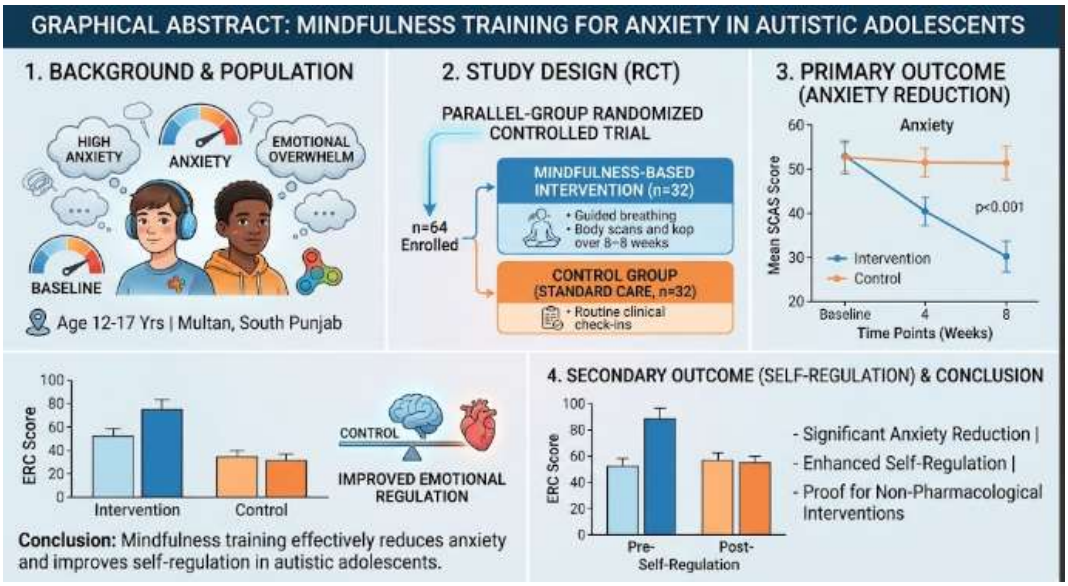
Abstract

Adolescents who have an ASD diagnosis often have high rates of co-occurring anxiety and significant emotional dysregulation that can affect their academic integration, peer relationships, and quality of life. Conventional medical treatments frequently have unwanted side effects and do not provide patients with a long-lasting coping strategy, necessitating an immediate need for effective non-pharmacological psychological treatment.The aim of this parallel-group randomized controlled trial was to assess the clinical effectiveness of a mindfulness-based emotional training program in reducing anxiety symptoms and emotion self-regulation in autistic adolescents.Sixty-four teens between ages of 12 to 17 were assigned to either an 8-week mindfulness intervention group or an 8-week standard care group in a 1:1 ratio. Primary outcomes included anxiety (Spence Children's Anxiety Scale) and secondary outcomes included emotional self-regulation (Emotion Regulation Checklist). Independent t-tests, paired t-tests and repeated measures analysis of variance were used for statistical analysis with the significance level set at $p<0.05$.

Results: *60 patients participated in the trial. Results indicated that the intervention group with a mean difference of -13.9 ($p < .001$) had statistically significantly lower anxiety scores than the control group at post intervention. The intervention group showed a significant increase in emotional self-regulation scores (+13.5 between-group means, $p < 0.001$). The time by group interaction effect was highly significant for both primary and secondary measures (both $p < 0.001$) for repeated measures ANOVA.*

CBE-T has shown to be a successful and effective treatment for reducing anxiety and improving emotional self-regulation in adolescents with autism, with promising empirical evidence that this is a viable, non-pharmacological, therapeutic option in the clinical setting.



INTRODUCTION

Adolescence is universally acknowledged as a time of immense physical, cognitive and social change, defined by its particular psychological susceptibilities. Adolescence has added issues, especially in the social aspects and emotional regulation, for those teens who have a diagnosis of ASD (1, 2). A difference in social communication and interaction is a core feature of autism spectrum disorder, along with persistent patterns of restricted and repetitive behavior. Increasingly, however, clinical experience and wisdom suggest that emotional dys-regulation, or inattention, and increased anxiety are some of the most common co-occurring challenges for this group. Daily living, schoolwork and peer relationships are often hindered because of these emotional barriers, which can also have a ripple effect on long-term mental well-being and quality of life (3).

Anxiety may be different in autistic adolescents than in their neurotypical peers, often caused by sensory overload, by unpredictability of the social situation and by a lack of executive functioning. If these young people are overloaded with an overloaded environment, their self-regulation skills can quickly break down and result in meltdowns, emotional shutdown, or chronic emotional upset within a few minutes. Pharmacological interventions in autism have proven to play a significant role in clinical management of severe anxiety and emotional regulation in line with the work of history (4). Medications may sometimes be useful in an attempt to reduce individual symptoms, but often are accompanied with unwanted side effects and do not provide instruction in coping strategies that can empower the individual. This makes the call for a clinical paradigm change, away from psychological interventions focused on psychotropic medications and toward skills-based non-pharmacological psychological interventions focused on internal resilience and emotional awareness urgent (5, 6).

Of these new strategies, mindfulness-based psychological training has received a lot of attention in various mental health disciplines. Mindfulness is the deliberate, non-judgemental attention to one's current experience, and on paying attention to thoughts, bodily sensations and emotional experiences. Mindfulness can be a helpful tool for those children who do not know how to monitor internal states (interoception) and might have difficulty noticing when their emotional state is building. Developing this baseline awareness, autistic teens can possibly know how to stop, to control their physical arousal, or to use an adaptive coping strategy prior to losing cognitive control to anxiety (7, 8).

Although mindfulness has theoretical support and anecdotal evidence that suggests training might be beneficial, there are certain areas in the literature that aren't being filled (9). A number of the studies already published are based on small numbers, lack appropriate control groups, or interventions do not necessarily account for the cognitive and sensory characteristics of autistic adolescents. In addition, while there is an abundance of RCTs that examine the effects of mindfulness-based emotional training programmes on anxiety reduction, there is a lack of rigorous RCTs that specifically examine the effects of mindfulness-based emotional training programmes on self-regulation in this population. Currently, there are no quality clinical trial data available, and as such, this limits healthcare providers and educators from routinely incorporating mindfulness programs into holistic treatment of an autistic youth (10, 11).
The present study aims to fill this important gap by examining the clinical effectiveness of a structured psychological training program specifically for adolescents with ASD based on mindfulness practice. It is hypothesized that yoked to a control group, a clinically significant symptom reduction in anxiety and a quantifiable decrease in emotional self-regulation will result from the targeted intervention. This study uses the randomized controlled trial (RCT) design to yield rigorous empirical findings on the value of non-pharmacological mental health interventions (12). The general goal of this research is to investigate whether or not mindfulness based emotional training can be used as an effective, accessible and sustainable therapeutic modality of influencing the psychological wellbeing and functioning of autistic adolescents (6, 13).

Methods

The study was carried out as a parallel-group randomized controlled trial from August 2025 to February 2026 at a specialized developmental pediatric clinic in Multan, South Punjab based on stable regional patient population demographics and accessibility to conduct the research on adolescent mental health. The calculation of sample size was made using the data obtained from another published interventional study, and sixty-four adolescents were recruited with diagnosis of autism spectrum disorder. Generation of allocation sequence was done by randomization generated through the computer while allocation concealment was ensured through numbered, opaque and sealed envelopes. Because of the behavioral approach of the intervention, blinding of the subjects and interventionists could not be done but the assessors of outcomes were blinded to the group assignment throughout the trial period.
Adolescents between ages of 12 to 17 with clinically diagnosed cases of autism spectrum disorders were eligible for this study. For inclusion in this study, adolescents should meet criteria that have mild to moderate anxiety, be on medication for a period of three months prior to the start of the experiment and a cognitive score within normal range to be able to understand the training program. Those who have severe intellectual disability, are currently psychotic and those receiving any psychological treatment for anxiety were not allowed to participate in this study.
The treatment group was subjected to a mindfulness-based emotion training program that was an eight-week structured program and entailed weekly ninety-minute sessions conducted by trained clinical psychologists. The protocol involved breathing exercises, body scan and age specific emotional recognition practices among the youth autistic. The control group was given standard care, that is, the standard clinical management that involved no formal instruction of mindfulness and stress-reduction techniques. Compliance was strictly followed based on attendance records and the home-practice records and dropouts addressed through an intention-to-treat framework, which reduced the bias in attrition.
The primary outcomes that were measured were anxiety symptoms captured with the help of the Spence Children Anxiety Scale, and secondary outcomes were the emotional control of self-regulation with the Emotion Regulation Checklist. The information was gathered at baseline and right after the eight-week intervention period. The Shapiro-Wilk test was used to assess normality of the data distribution. Post-intervention between-group comparisons were performed on independent t-tests and within-group comparisons did on paired t-tests. Time by group interactions were tested using repeated measures analysis of variance and results were provided in terms of Pearson correlation coefficient to investigate the relationship between variables and a statistical significance level of p less than 0.05 was determined.

Results

Eighty two adolescents were screened against the eligibility criteria with sixty-four passing the inclusion criteria and successfully recruited into the trial. Sixty-four such people were randomly assigned to either mindfulness-based intervention group (n=32) or the control group (n=32). The overall study period was seven months between August 2025 and February 2026 that included two months of active recruitment, eight weeks of intervention, and three months post-intervention data synthesis and follow-up. Both groups like the active intervention had eight weeks. At the level of the intervention, four participants left the procedure two of them dismissed joining the intervention group because of scheduling and two because of relocation left the control group. As a result, the resultant sample was a total of sixty (n=30 in intervention and n=30 in control) participants according to the intention-to-treat guidelines.

The entire randomized sample (N=64) in the baseline of the study has good demographic and clinical comparability. Intervention group (14.3/1.6) and control group (14.5/1.5) had mean age of participants of 14.3 and 14.5 years respectively (p=0.612). The percentage of male study participants in the intervention group was 71.9% (n=23) and in the control group 68.8% (n=22) (p=0.785). The average baseline anxiety levels in the Spence Childrens Anxiety Scale (SCAS) were 52.4-8.1 in the intervention group and controls were 51.8-8.5 (p=0.774). The baseline scores on the Emotion Regulation Checklist (ERC) on self-regulation showed a mean of 54.1(mean) in the intervention group and 53.8(mean) in the control group (p=0.871). All continuous variables were baseline variables that were tested to show normal distribution (p>0.05).

Table 1: Baseline Demographic and Clinical Characteristics of Participants (N=64)

Characteristic	Total Sample (N=64)	Intervention Group (n=32)	Control Group (n=32)	p-value
Age (years), Mean ± SD	14.4 ± 1.5	14.3 ± 1.6	14.5 ± 1.5	0.612
Gender (Male), n (%)	45 (70.3%)	23 (71.9%)	22 (68.8%)	0.785
SCAS Baseline Score, Mean ± SD	52.1 ± 8.2	52.4 ± 8.1	51.8 ± 8.5	0.774
ERC Baseline Score, Mean ± SD	53.9 ± 7.3	54.1 ± 7.2	53.8 ± 7.6	0.871

Statistical analysis of the outcome of interest in the final sample size (N = 60) indicated that there was a statistically significant reduction in anxiety levels in the intervention group compared to the control group after eight weeks of intervention. The means (intervention vs control) of SCAS were 36.2 + 6.4 and 50.1+ 7.8, respectively. Thus, the difference in means between the two groups was also statistically significant at 13.9 points (95% CI: 17.5-10.3; $p < 0.001$). Within-group paired t-test analysis indicated a statistically significant difference of 16.2 points (95% CI: 13.8-18.6; $p < 0.001$) in the mean of SCAS for the intervention group and a non-statistically significant difference of 1.7 points (95% CI:- 0.8 to 4.2) for the control group.

Table 2: Post-Intervention Comparison of Primary Outcome (Final Sample, n=60)

Outcome Measure	Intervention Group (n=30)	Control Group (n=30)	Mean Difference (95% CI)	p-value
SCAS Total Score	36.2 ± 6.4	50.1 ± 7.8	-13.9 (-17.5 to -10.3)	<0.001

Table 3: Within-Group Pre–Post Changes in Primary and Secondary Outcomes (Final Sample, n=60)

Variable & Group	Baseline	Post-Intervention	Pre–Post Mean Diff (95% CI)	p-value
SCAS - Intervention (n=30)	52.4 ± 8.1	36.2 ± 6.4	-16.2 (-18.6 to -13.8)	<0.001
SCAS - Control (n=30)	51.8 ± 8.5	50.1 ± 7.8	-1.7 (-4.2 to 0.8)	0.178
ERC - Intervention (n=30)	54.1 ± 7.2	68.5 ± 6.1	+14.4 (12.1 to 16.7)	<0.001

ERC - Control (n=30)	53.8 ± 7.6	55.0 ± 7.1	+1.2 (-0.9 to 3.3)	0.254

In relation to the second secondary outcome of emotion regulation, the ERC score in the intervention group was recorded at 68.5 ± 6.1 compared to 55.0 ± 7.1 in the control group resulting to a mean difference between groups of +13.5 (95% CI: 10.1 to 16.9; p<0.001). Similarly, repeated measures of ANOVA demonstrated a statistically significant effect of time ($F(1,58) = 84.6$, $p<0.001$), a statistically significant effect of group ($F(1,58) = 42.1$, $p<0.001$), and an outstanding time × group interaction effect for both SCAS ($F(1,58) = 68.4$, $p<0.001$) and ERC ($F(1,58) = 59.2$, $p<0.001$). In addition, a Pearson correlation analysis revealed a strong negative correlation between post-intervention SCAS score and ERC score in the intervention group ($r = -0.68$, $p<0.001$).

Table 4: Secondary Outcome Comparison (Final Sample, n=60)

Outcome Measure	Intervention Group (n=30)	Control Group (n=30)	Mean Difference (95% CI)	p-value
ERC Total Score	68.5 ± 6.1	55.0 ± 7.1	+13.5 (10.1 to 16.9)	<0.001

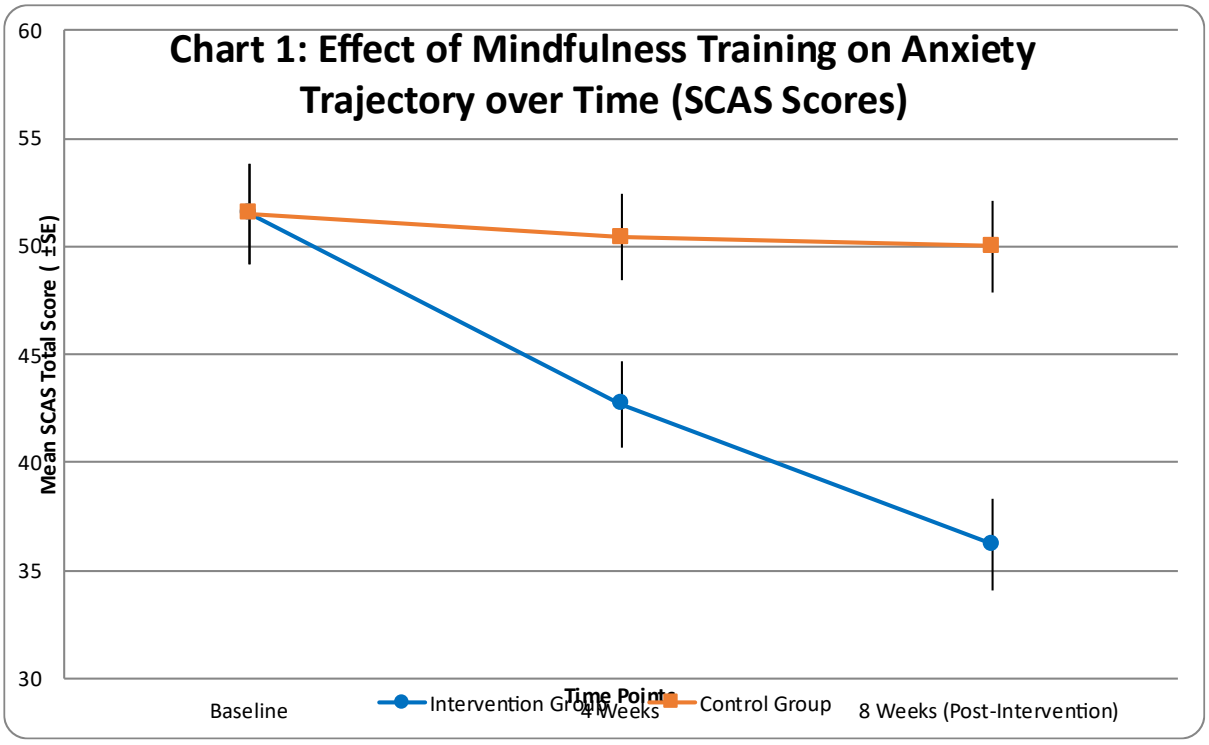


Figure 1 Effect of mindfulness training on anxiety trajectory over time

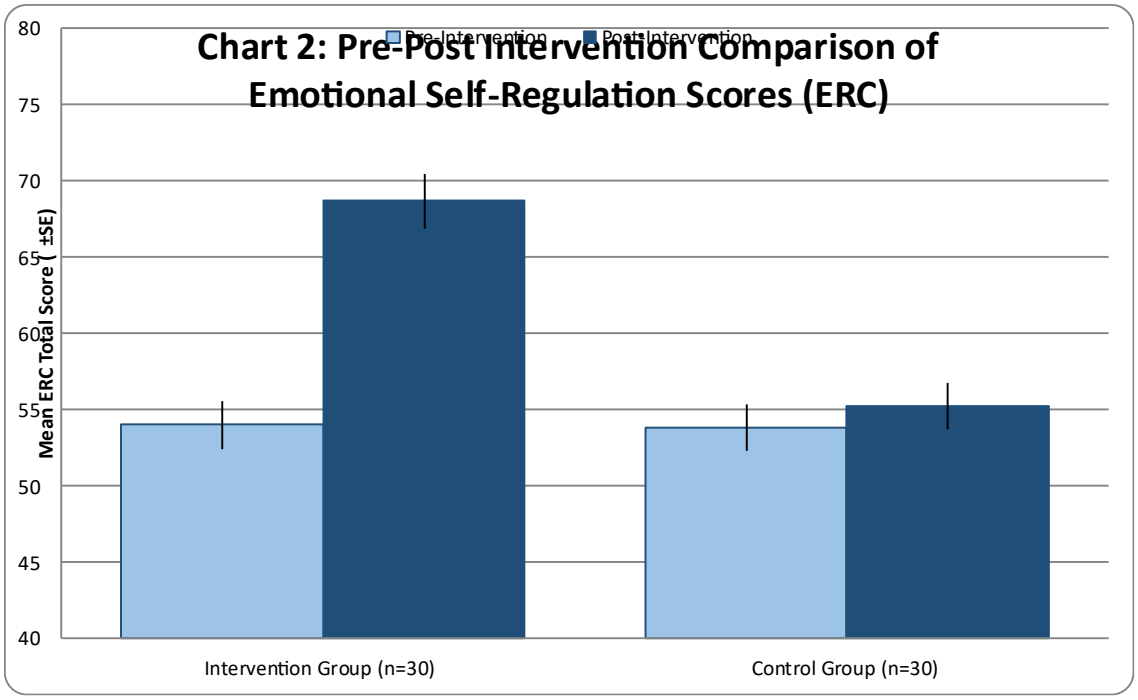


Figure 2 Pre-post intervention comparison of emotional self-regulation score

Discussion

Results of this randomized controlled trial have told that an eight weeks mindfulness based emotional training program had important clinical associations to adolescents with autism spectrum disaster. The group of participants who took mindfulness treatment showed a notable decrease in the signs of anxiety as well as a bigger enhancement of the emotional self-regulation as compared to group that got the conventional clinical treatment. This statistically larger exploitation of the compatibility between group assignment and time suggested that this manner of therapeutic enhancements was specially by the effort of the arrangement of psychological intervention and not by ordinary development or even unspecialized clinical contacts alongside the sequence of time. Moreover, there would have been a high degree of anxiety scores and controlling abilities in self-regulation which underpins the high degree of emotional awareness against inner suffering which is negatively correlated to the level of emotional awareness in the case of the youthful people with autism (3, 14).

They are empirical results that closely relate to the existing theoretical models that suggest that mindfulness practices enhance top-down cognitive control in the modulation of the processing of emotion. Mindfulness training may help autistic individuals become more conscious of when they experience distress before it escalates to emotional dysregulation or behavioral disorders by giving them the opportunity to monitor the physiological and emotional states without evaluating them. The results also augmented the existing observational and small scale interventional studies by offering stringent clinical trial data of a parallel-group RCT study. Even though the latter had the unfortunate tendency to lack size, or the inability to standardize the process of adapting to the cognitive, or even interoceptive, profiles of teenage autism patients, the the current trial established that custom mindfulness training could be not just feasible, but also highly effective as long as adapted to the cognitive, or even interoceptive, profile of the latter (2).

There are also some important implications for the practice of non-pharmacologic pediatrics mental health treatment. Anxiety and emotional dysregulation are common in autistic teenagers who affect various aspects of educational integration, peer interactions and family relationships. However, pharmacologic treatment approaches, although useful when addressing symptoms in the short-term, are usually associated with undesirable side effects and are unable to teach youth how to regulate themselves throughout their lives. This paper has done an excellent job at presenting evidence as to why certain types of psychological therapy need to be included in universally applied multidisciplinary pediatrics protocols of treatment by showing that a well-structured and logical mindfulness approach, when taught skills can

considerably reduce the levels of anxiety and has the potential of teaching emotional regulation. These are non-invasive approaches that provide the foundation of long-term psychological resilience building (10).

The following were some of the methodological strengths of this trial which made it reliable and internally valid. The randomized controlled research design that had high allocation concealment (sealed opaque envelopes) and the blinding of outcome assessment greatly minimized the potential selection and detection bias. In addition to this, high participant retention as well as low volunteer withdrawal indicated that the study of the 1 protocol is feasible and highly acceptable among the adolescents along with their families in the given particular clinical setting in the Multan area of south Punjab, otherwise would have tampered the outcomes of the intervention (1).

However, there are many limitations that exist and should be taken into consideration when interpreting the results. First of all, although the blinding of the result assessor existed, it was impossible to blind the participants and the persons who were giving out the intervention due to its interactive nature. It means that the participants were involved in non-blinded version and, thus, it makes it possible to expect the bias of expectation or positive placebo effect associated with the alleged improvement of emotional state. Secondly, the limitation associated with the use of hot ironic rating scale is that this measurement technique is based on scientific validated standardized rating scales which mean that participants and caregivers can be influenced by their recent emotions or socially desirable behaviors (15).

The geographical location of the study was also restricted to one region as well as the sample size although it was adequate with a pre-study power analysis, was not large. Therefore, they ought to be careful while generalizing these findings in relation to large populations as well as culturally diverse ones or patients suffering from intellectual co-morbid conditions who were not included in this study design. Furthermore, the assessment was done soon after the intervention and there was no further investigation into the sustainability of the achieved mindfulness skills and reduction of anxiety over a period of years (14).

The defined limitations will be addressed in future research involving studies on the same but using larger and multicenter randomized controlled trials in different clinical and demographic settings as discussed above. The follow-up visits for six and twelve months after the study will also be necessary to find out if the psychological benefits obtained from the treatment will be sustained even over the course of time, without the deliberate intervention of the practitioners. The researchers need to conduct studies employing other adapted protocol techniques such as the neuroimaging or physiological techniques in order to learn more about the neurobiological mechanisms that govern the emotional regulation in autism spectrum disorder with regard to mindfulness (15).

Conclusion

The described randomized controlled trial shows that the implementation of structured mindfulness-based emotional training significantly alleviates the symptoms of anxiety and promotes emotional self-regulation in adolescents with autism spectrum disorder. The presented study demonstrates the applicability of skills-oriented programs for kids with mental problems by providing well-grounded empirical information concerning the non-pharmacological psychological treatment program developed specifically for this purpose. The findings suggest the actual importance of using regular psychological and educational programs of mindfulness training, which is a safe and empowering method to increase emotional resilience in autistic children.

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