

Effect of Mindfulness Intervention on Inattentive Behaviors in Children at Risk for ADHD: A Single-Subject Study

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Abstract

Mindfulness is the increased awareness that arises when we pay attention on purpose to the present non-judgmentally. To investigate the influence of mindfulness on inattentive behaviors in children at risk for attention deficit hyperactivity disorder (ADHD), a single-subject A-B-A reversal experimental design was adopted in which two children at risk for ADHD received 6-week mindfulness training, with 20-30 minutes per session and 3-4 times per week. The results based on visual analysis, C-statistics, and social validity analysis showed that mindfulness training was effective in reducing the duration of inattentive behaviors in children at risk for ADHD, and that the training could improve the function of the attention network in these children, which could be reflected in the increased efficiency in the vigilance network and the executive function network.

Keywords: attention network, children at risk for ADHD, inattentive behavior, mindfulness, single-subject study

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder in children characterized by attention deficit or hyperactivity. About 5% of children worldwide meet the diagnostic criteria for ADHD (Meppelink et al., 2016). Domestic statistics show that the overall prevalence of children with ADHD in China is 5.6%, and most children with ADHD are confronted with academic difficulties (Li et al., 2018). One of the core symptoms of children with ADHD is inattentive behaviors, which prevent them from maintaining attention on teachers' instructions and accurately completing classroom tasks, and this seriously hinders their learning process, leading to the weakening of classroom functions (Gaastra et al., 2016). Therefore, reducing children's inattentive behaviors has become the central goal in the treatment for children with ADHD (Colomer et al., 2017).

In recent years, mindfulness has been gradually applied as a psychotherapy intervention for inattentive behaviors in ADHD (Cairncross & Miller, 2016). Mindfulness is the increased awareness that arises when we pay attention on purpose to the present non-judgmentally (Kabat-Zinn, 2013). Multiple empirical data reviewed by Evans (2018) demonstrated that mindfulness training can effectively improve inattentive behaviors and increase learning engagement behaviors in children with ADHD. A multi-baseline study conducted by Carboni et al. (2013) with four 8-year-old children with ADHD showed an increase in the duration of children's attentive behaviors and a significant decrease in parents' and teachers' ratings of inattentiveness after mindfulness intervention. Although a series of studies has been conducted on the subject, there is a singularity in the measurement indicators of inattentive behaviors, and only a few relevant studies have been conducted in China. Existing studies mostly focus on children who have been diagnosed with ADHD, but little attention is paid to children at risk for ADHD who do not meet diagnostic criteria. One study that screened 17,440 students from Grade 1 to 5 showed a high detection rate of 18.1% for children at risk for ADHD (Barry et al., 2016). Compared with their peers, these children not only

are troubled by their own symptoms and lag behind in the abilities of sustained attention, impulse control, and activity regulation, but also have less self-control and more disruptive and inattentive behaviors, which seriously affect their classroom performance and academic achievement (Gaastra et al., 2016).

Therefore, the present study was designed to examine the effects of mindfulness on inattentive behaviors and attention in children at risk for ADHD by using a single-subject reversal design. Two children at risk for ADHD were recruited for mindfulness intervention. The level of children's inattentive behaviors was evaluated through observation of duration of target behaviors, the SNAP-IV Rating Scale, and the Conners' Teacher Rating Scale. The child version of the Attention Network Test (ANT) was used to investigate the influence of mindfulness intervention on attention network. The purpose of this study was to provide educators with empirical support for ADHD intervention strategies.

2. Method

2.1 Participants

Two children at risk for ADHD were recruited from a primary school. The selection criteria were as follows: (1) attending a general school; (2) meeting the screening criteria of SNAP-IV Rating Scale; (3) meeting the assessment criteria of the Conners' Teacher Rating Scale; and (4) the willingness of the children, parents, and teachers to cooperate in the mindfulness training. Combined with on-site observations, teacher interviews, and communications with students, 2 students meeting the above criteria were selected. Following is the specific information of the participants.

Xiao Ke (pseudonym), male, 10 years old, second grader. In terms of his scores on the SNAP-IV Rating Scale, inattention factor accounted for 95%, hyperactivity-impulsivity factor accounted for 95%, and opposition-defiance factor accounted for 65%. As for results on the Conners' Teacher Rating Scale, hyperactivity index was 1.70, inattention-passivity score was 2.50, hyperactivity-impulsivity score was 1.29, and conduct score was 1.13. He had a short attention span in class, and he often stared in a daze and looked around. He also represented a series of behaviors such as fidgeting, playing with corners of clothes, and squirming. His attention was easily distracted by slight noise outside. Regarding academic performance, his grades fluctuated at the passing line, and with regard to homework, he procrastinated, scribbled, and often missed the deadline.

Xiao Liang (pseudonym), male, 10 years old, second grader. In terms of his scores on the SNAP-IV Rating Scale, inattention factor accounted for 99%, hyperactivity-impulsivity factor accounted for 95%, and opposition-defiance factor accounted for 90%. As for ratings on the Conners' teacher Rating Scale, hyperactivity index was 1.70, inattention-passivity score was 2.20, hyperactivity-impulsivity score was 1.87, and conduct score was 1.63. As for his class performance, the student possessed obvious inattentive behaviors. He often looked to his left and right. In particular, he lay on the desk, gazed out of the window, or stared at a place during monotonous learning tasks. He frequently played with stationery or origami on the desk, he often did not take out his books in class, and sometimes left his seat and disturbed other students. Academically, he had low grades and failed most of the subjects. His score in Chinese was only 8.

2.2 Research Design and Procedure

A single-subject A-B-A reversal design was used in the present study, and the study procedure was divided into three phases (i.e., the baseline phase, intervention phase, and reversal phase). The measurements included the duration for inattentive behaviors and scores of the SNAP-IV Rating Scale, Conners' Teacher Rating Scale, and ANT.

One-to-one intervention was conducted in the training room of the school where participants were enrolled. In baseline phase (A_1), we recorded the duration of individual inattentive behaviors according to the operational definition through the Target Behavior Observation Form, and generated baseline data. The baseline phase lasted 6 days, during which measurement was carried out once a day, with a total of 6 data points obtained, and the ANT was also conducted. After the baseline phase, the two children entered the intervention phase (B) and received a 6-week mindfulness intervention, which was conducted 20–30 minutes per session and 3–4 times per week. A total of 19 sessions were conducted for each child. After each session, the inattentive behaviors in class for each child was recorded through the Target Behavior Observation Form. The intervention phase was following by the reversal phase (A_2). The duration of inattentive behaviors for each child was recorded using the Target Behavior Observation Form. The reversal phase lasted 5 days and the measurement during this phase were conducted once a day, with 5 data points in total. The ANT was administered to the participants again, and the teachers were asked to complete the SNAP-IV Rating Scale and Conners' Teacher Rating Scale.

2.3 Target Behavior Definition and Data Collection

Combining the records of problematic behaviors of the two children in the class (lasting 5 days and 15 min per day) with the existing research and teacher interviews, the operational definition of inattentive behaviors for the two children was defined as behaviors not directing attention to learning activities or engaging in activities irrelevant with learning for more than 10 seconds, including looking around, playing with pencil cases, folding papers, or playing with fingers.

Recording of inattentive behavior duration was performed from an observational location that avoided the participant's sight. The behaviors of the two children in their Chinese classes were observed and recorded for 15 minutes. According to the operational definition of the target behavior, the recording time started when the child showed inattentive behaviors and continued until the inattentive behaviors disappeared. When the next target behavior appeared, the duration was accumulated over the previous duration, so as to obtain the total duration of the target behavior during the observation period.

2.4 Research Tools

2.4.1 Target Behavior Observation Form

In order to track the changes of the children's inattentive behaviors before and after the implementation of mindfulness training, we compiled a Target Behavior Observation Form according to the characteristics of the participant's problematic behaviors in class. This form was applied to record the percentage of time that the children's target behavior lasted during the observation periods during the baseline, intervention, and reversal phases of the study.

2.4.2 Conners' Teacher Rating Scale

The Conners' Teacher Rating Scale is widely applied in the screening of children with ADHD (Fu, 2020). The scale was used during the baseline and reversal phases. Fan and Du (2004) examined the reliability of the scale and showed that the internal consistency reliability of the scale was 0.941, the consistency between items and total score was 0.265-0.689, and the test-retest reliability was 0.391-0.671.

2.4.3 SNAP-IV Rating Scale

The SNAP-IV Rating Scale is commonly used to evaluate children with ADHD and was applied during the baseline and reversal phases in the present study. The scale is composed of three subscales, namely inattention, hyperactivity-impulsivity, and opposition-defiance. Gao et al. (2009) translated the scale into Chinese and showed that the test-retest reliability of the translated scale was 0.60-0.84, the internal consistency reliability was 0.88-0.95, and the concurrent validity was 0.61-0.84, which indicated good reliability and validity.

2.4.4 Attention Network Test

A child version of the ANT developed by Rueda et al. (2004) was used to test the executive control, vigilance, and directed subnetworks of attention. The test procedure was as follows: at the beginning of the test, a warning clue "+" appeared in the center of the screen. After 400ms, direction clues were presented (including no clues, effective clues, and ineffective clues). After 50ms, a target stimulus appeared, which was a group of little fish. Participants were required to judge the orientation of the little fish in the middle by pressing a button. If the participant responded correctly, the fish in the middle would spit bubbles and move its tail. There would be no animation in case of incorrect or no response. The entire test was divided into 4 sessions, including a practice session and three formal sessions. The test lasted 30 minutes. Pressing the wrong buttons or the lack of a response were considered incorrect responses.

2.5 Intervention Protocol

Based on the psychological development characteristics of children at risk for ADHD and the mindfulness program developed by Greenland (2010), we designed a mindfulness training program for the participants. The program was conducted 3-4 times a week, 20 to 30 minutes each session, for a total of 19 sessions. Please see Table 1 for details.

Table 1. Mindfulness Training Schedule for Children at Risk for ADHD

Stage	Name	Objective	Content
Stage One Open gates of senses	Voices in the air	Audition	Detection of timbre, tone, sound, duration, and tempo.
	Mystery bag	Tactile sensation	Experience of the object thickness, roughness, weight, and temperature.
	Puppy nose	Olfaction	Discrimination and comparison of different smells of eraser, perfume, coffee, and coke.
	A raisin	Gustation	Discrimination of different tastes including sour, sweet, bitter, spicy, salty.
	Ticking time	Vestibular sense	Guiding children to swing their bodies regularly and repeatedly through following the rhythm.
Stage Two Breath and body	Quiet walk	Proprioception	Feeling when walking by lifting legs, moving, and stepping.
	Rocking the doll to fall sleep	The rhythm of the body with the breath	Paying attention to the feeling brought by the breath and focusing on the breath itself.
	Seed grows into tree	Body coordination movement	Experiencing body stretching.
	Lion and Monkey	Body coordination movement	Experiencing a sense of movement and balance.
	Vertical stretch	Body stretching	Experiencing a full body stretch.
	Simon says	Execution of attention network	Guiding children to use the attention network to filter competing information through verbal instructions and visual suppression.
Stage Three Emotion awareness	A good sleep	Body scan and relaxation	Awareness of every body part and relax.
	Serene heart	First known to breath	Feeling the relationship between breath and thoughts/emotions.
	Sit still like a frog	Feeling breath	Experiencing the feeling of breathing while sitting still.
	A little voice in head	Perceiving thoughts	Awareness of thoughts coming and going.
	Annoying bag		
	Mental weather report	Perceiving emotions	Arousing emotions with different events or actions, practicing how to complete a weather report, teaching the child to learn the constant change of emotion, and focusing on feeling emotions but not getting caught up in emotions.
	Ice melting	Connect thoughts and emotions	Regulating children's negative emotions through tactile stimuli and experiencing emotions through meditation.
	STOP	Dealing with strong emotions	Stop, take a deep breath, observe, and continue.
Gratitude chain	Gratitude	Children gain care and empathy.	

3. Results

3.1 Visual Analysis of Mindfulness Intervention for Inattentive Behaviors

The percentage of inattentive behavior duration in class for Xiao Liang and Xiao Ke are shown in Figure 1. We established the coordinate system with the evaluation times as the abscissa and the percentage of target behavior duration as the ordinate. Visual analysis and C-statistical analysis were used to analyze the data. Visual analysis was divided into two main parts (i.e., within-phase and between-phase). The within-phase analysis was aimed at exploring the ranging, variation, and average of the relevant data during a specific experimental phase. The between-phase analysis was performed to compare data between experimental phases and to calculate the overlap percentage. Meanwhile, C-statistics of simplified time series studies was used to evaluate the change of treatment effects. Please see details in Table 2.

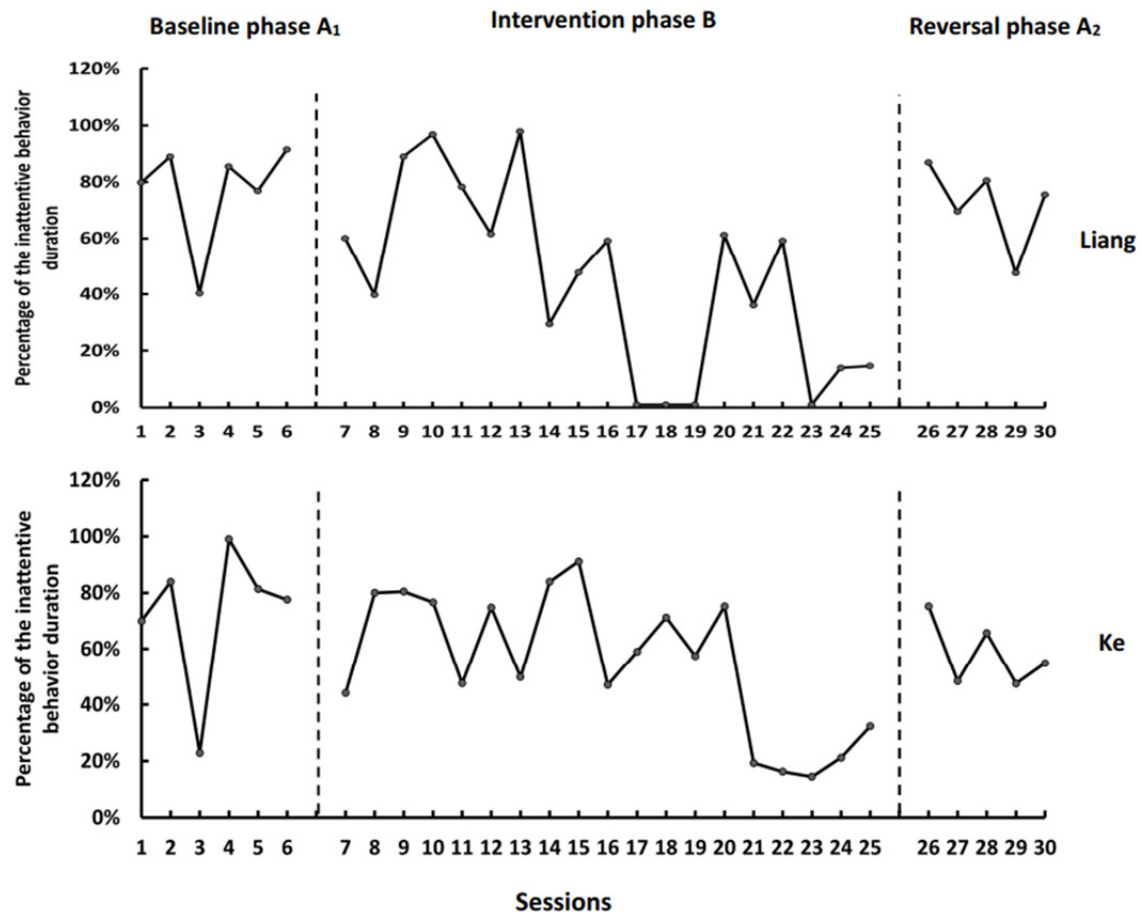


Figure 1. Change in effects of mindfulness training on inattentive behaviors

Table 2. Visual Analysis of the Proportion of Inattentive Behavior Duration

Participants	Xiao Liang			Xiao Ke		
	Baseline phase A ₁	Intervention phase B	Reversal phase A ₂	Baseline phase A ₁	Intervention phase B	Reversal phase A ₂
Duration	6	19	5	6	19	5
Trend estimate	/(-)	\(+)	\(+)	/(-)	\(+)	\(+)
Trend stability	Stable	Unstable	Stable	Unstable	Unstable	Stable
Mean level	77.14%	44.66%	71.98%	72.44%	54.82%	58.31%
Level stability	83.33%	47.37%	80.00%	66.67%	28.00%	80.00%
Level range	40.33%-91.47%	1.00%-97.89%	47.5%-86.89%	22.87%-99.00%	14.44%-91.11%	47.50%-75.22%
Change in level	91.47%-79.75%	60%-14.67%	86.89%-75.5%	77.53%-70%	32.33%-44.07%	54.83%-47.50%
	11.72%	45.33%	11.39%	7.53%	-11.74%	-20.39%
C-value	-0.3454	0.4483	-0.2580	-0.4743	0.5759	-0.2376
Z-value	-1.0217	2.0631*	-0.7298	-1.4028	2.6503**	-0.6721
Between-phase level change	A ₁ / B	B / A ₂		A ₁ / B	B / A ₂	
Within-phase level change	45.14%	72.22%		-33.46%	42.89%	
Average level change	-32.47%	27.32%		-17.62%	3.49%	
Change in trend direction and effect	/ \	\ \		/ \	\ \	
	(-) (+) Positive	(+) (+) No change		(-) (+) Positive	(+) (+) No change	
Change in trend stability	Stable to unstable	Unstable to stable		Unstable to stable	Unstable to stable	
Overlap rate	52.63%	100.00%		21.05%	100.00%	
C-value	0.4768	0.3793		0.3196	0.4116	
Z-value	2.4834**	1.9392*		1.6648*	2.1042*	

Note. * $p < 0.05$, ** $p < 0.01$)

3.2 Analysis of the Changes in Participants' Target Behaviors

During baseline phase A_1 , the mean value of the percentage of inattentive behavior duration of Xiao Liang reached 77.14% and trend stability was 83.33%. The results of C-statistics showed a non-significant difference ($C=-0.3454$, $Z=-1.0217$, $p>0.05$), which indicated that the inattentive behaviors of Xiao Liang were in a highly stable state before intervention. During the intervention phase B, the inattentive behaviors showed an unstable downward trend with an average value of 44.66% and trend stability was 47.37%. In addition, the results of C-statistics were $C=0.4483$, $Z=2.0631$ ($p<0.05$), which indicated that there was a significant decrease in inattentive behaviors during the intervention phase. After stopping the intervention and entering reversal phase A_2 , the mean value rebounded to 71.98% and the trend stability was 80.00%. The results of C-statistics showed no significant difference ($C=-0.2580$, $Z=-0.7298$, $p>0.05$), which indicated that the intervention effect was retained during the reversal phase.

As the baseline phase A_1 ended and turned to the intervention phase B, the percentage of target behavior duration of Xiao Liang decreased from 91.47% at the end of baseline phase to 60.00%, and the trend prediction was positive. C-statistics showed significant differences between phases ($C=0.4768$, $Z=2.4834$, $p<0.01$), which demonstrated the positive effect of mindfulness training and that it significantly reduced Xiao Liang's inattentive behaviors. As intervention phase B turned into reversal phase A_2 , the percentage of target behavior duration increased from 14.67% at the end of intervention phase B to 86.89%. The C-statistics showed significant differences ($C=0.3793$, $Z=1.9392$, $p<0.05$), indicating that the duration of Xiao Liang's inattentive behaviors increased after the withdrawal of mindfulness intervention.

During baseline phase A_1 , the mean value of the percentage of Xiao Ke's inattentive behaviors reached 72.44% and trend stability reached 66.67%. No significant difference was shown in C-statistics ($C=-0.4743$, $Z=-1.4028$, $p>0.05$), and the behaviors were in a stable state. When entering the intervention phase B, the inattentive behaviors showed an unstable downward trend with an average value of 54.82% and trend stability of 28.00%. In addition, the results of C-statistics were $C=0.5759$, $Z=2.6503$ ($p<0.01$), indicating that the inattentive behaviors of Xiao Ke were significantly reduced during the intervention phase. After stopping the intervention and entering reversal phase A_2 , the average value bounced back to 58.31% and trend stability was 80.00%. The results of C-statistics did not show any significant difference ($C=-0.2376$, $Z=-0.6721$, $p>0.05$), indicating that the intervention effect was retained during the reversal phase.

As the baseline phase A_1 ended and turned to the intervention period B, the percentage of target behavior duration of Xiao Ke decreased from 77.53% at the end of baseline phase A_1 to 44.07%, and the trend was predicted to be positive. The results of C-statistics were significant ($C=0.3196$, $Z=1.6648$, $p<0.05$), indicating a prominent intervention effect of mindfulness training on target behaviors and a significant decrease in inattentive behaviors. When moving from intervention phase B into reversal phase A_2 , the percentage of target behavior duration increased from 32.33% at the end of the intervention period B to 75.22%. C-statistics showed that the change in inattentive behaviors between phases was significant ($C=0.4116$, $Z=2.1042$, $p<0.05$), indicating that the duration of the target behavior of Xiao Ke showed a rebound after the withdrawal of mindfulness intervention.

An effect size analysis was conducted using the mean differences to exclude the influence of the sample size on the statistical power. By analyzing the data from the baseline and intervention phases, the effect size of target behavior was $M_{SMD}=1.72$ for Xiao Liang and $M_{SMD}=0.68$ for Xiao Ke. Therefore, the target behaviors of both participants reached a large effect size, indicating that mindfulness training had a positive effect in improving the target behaviors.

In conclusion, the inattentive behaviors of both participants remained stable at a high level during the baseline phase. The percentage of inattentive behavior duration of the two participants significantly decreased after mindfulness training. There was a trend of increase in inattentive behaviors and retention of intervention effect during the reversal period.

3.3 Analysis of the Results of SNAP-IV Rating Scale

The results of SNAP-IV Rating Scale are shown in Table 3. After the mindfulness training intervention, the scores of the inattention factor in both participants were decreased. In particular, there was an obvious decrease in the scores of hyperactivity-impulsivity and opposition-defiance for Xiao Ke, but the scores of hyperactivity-impulsivity and opposition-defiance for Xiao Liang did not decrease significantly. The results indicated that the mindfulness training intervention was effective in improving the distraction symptoms of both participants.

Table 3. Results of SNAP-IV Rating Scale

	Xiao Liang		Xiao Ke	
	Before intervention	After intervention	Before intervention	After intervention
Inattention	25	23	25	16
Hyperactivity-Impulsivity	18	23	18	12
Opposition-Defiance	12	16	12	8

3.4 Analysis of the Results of Conners' Teacher Rating Scale

The comparison of results of the Conners' Teacher Rating Scale showed that the scores of hyperactivity, hyperactivity index, conduct problems, and inattention-passivity were significantly reduced in both participants after the intervention training, indicating that mindfulness training was effective for both participants in improving the level of attention, reducing bad behaviors and impulse-hyperactivity symptoms as well as improving hyperactivity symptoms.

Table 4. Results of Conners' Teacher Rating Scale

	Xiao Liang		Xiao Ke	
	Before intervention	After intervention	Before intervention	After intervention
Conduct problems	1.63	1.13	1.13	0.88
Hyperactivity	1.86	1.00	1.29	0.57
Inattention-passivity	2.50	2.22	2.50	2.13
Hyperactivity index	2.20	1.30	1.70	1.10

3.5 Analysis of the Results of Attention Network Test

The results of reaction time in the ANT were analyzed by first excluding the missed reactions, wrong reactions, and reactions with a duration less than 100ms. The comparison of the average reaction time before and after the intervention showed that the reaction time of the executive control network decreased and the reaction time of vigilance network increased in both participants, indicating that the efficiency of the executive control network and the vigilance network of attention improved after the mindfulness training. The reaction time of the directed network of Xiao Ke decreased after the intervention, while that of the directed network of Xiao Liang increased after the intervention. This indicated that the efficiency of the directed network of Xiao Liang was improved and that of Xiao Ke decreased after the intervention.

3.6 Social Validity Analysis

After the intervention, open-ended interviews were conducted with the head teachers and subject teachers of both Xiao Liang and Xiao Ke to understand the impact of mindfulness training on their inattentive behaviors and the teachers' satisfaction with the intervention. During the interviews, both subject teachers expressed that after the mindfulness intervention, the children's inattentive behaviors decreased, and participation in classroom tasks increased, and that they were generally satisfied with the effect of the intervention. The head teachers expressed to us that "Xiao Ke has changed a lot, he is not in a frequent daze anymore, and he is now more actively raising hands to answer questions." As for Xiao Liang, the head teacher said, "Before the training, Xiao Liang always slept in math class or left his seat to whisper something to other students. Recently, the biggest change and progress that Xiao Liang has made is that he would take out the textbook and raise his hands to answer questions." When talking about the reasons for the change in inattentive behaviors, the head teachers affirmed the role of mindfulness training and mentioned that the training content was very relevant as it targeted the students' distractions. Besides, the novelty and fun of students participating in mindfulness training for the first time increased their sense of involvement. However, teachers expressed concerns about the long-term effect of the intervention and believed that its ability for continuous improvement needed further observation.

4. Discussion

4.1 Mindfulness Training Effectively Alleviates Inattentive Behaviors of Children at Risk for ADHD

In this study, it was found that the percentage of inattentive behavior duration in both participants decreased significantly after the intervention, indicating that mindfulness training can improve inattentive behaviors in children at risk for ADHD. Attention refers to concentrating on a specific object, which coincides with the core of mindfulness training. Existing studies have proved that conscious awareness of current experience is a key factor for the effectiveness of mindfulness (Rahl et al., 2017). Mindfulness emphasizes focusing on a specific object, including the current physical sensations, emotions, thoughts, etc., allowing for distractions and redirecting attention to the object of focus, which maximizes sustained attention. In this study, mindfulness training enabled children to open their senses, perceive breathing, emotions, and thoughts, pay attention to distractions but not get involved in them, and then gently bring attention back to the object of focus, thus enhancing sustained attention. As Xiao Liang shared in a mindfulness training class, "I know there is a line between me and the teacher when I listen carefully, but when my mind goes to the chicken at home, the line breaks." It was clear that Xiao Liang was aware of the current experience. In the following class, whenever he stared out of the window and remained motionless, he would consciously shake his head, straighten his body, and turn his eyes to the teacher again. This shows that mindfulness training helped Xiao Liang to consciously respond to stimulus and constantly bring his attention back to the present focus.

4.2 Mindfulness Training Improves the Attention Network of Children at Risk for ADHD

The results of the ANT showed that the attention network of both participants improved after the mindfulness intervention, as reflected in the improvement of vigilance network and executive function. Attentive vigilance refers to the state of being highly sensitive to external information, and the behavior related to persistent attention is one of the main evaluation indexes of the efficiency of vigilance network. Mindfulness training enables children to keep their mind open and consciously aware of internal and external stimulation, enhances their sensitivity to information, and improves the efficiency of their attention and vigilance networks to a certain extent. The psychological mechanism through which mindfulness works is related to the improvement of executive function (Li et al., 2019). Executive function refers to a set of higher cognitive abilities that are responsible for a high level of activity control process when an individual completes a specific task. Previous studies have found that mindfulness level is significantly negatively correlated with inhibition difficulty, working memory difficulty, and conversion difficulty (Bogels et al., 2018; Geronimi et al., 2020). In a previous study, an experimental group that received short-term mindfulness intervention showed a significant increase in activities in the anterior cingulate cortex associated with the executive control network (Kwak et al., 2020). In this study, children had to observe and respond non-judgmentally to the emergence of new stimuli in a controlled manner, and were guided to feel first rather than react automatically when a strong emotion rose. This process required the involvement of children's self-awareness and inhibitory control ability, which facilitated the enhancement of children's executive functions, and in turn, the improvement in their attention problems.

4.3 Limitations and Areas for Future Research

This study aimed to develop an appropriate mindfulness intervention program for children at risk for ADHD, to provide new ideas for intervention strategies and approaches for children at risk for ADHD, and to provide empirical support for schools to implement mindfulness education. However, the study has certain limitations. First, the A-B-A single-subject reversal design was adopted without multiple replications of the intervention condition. Therefore, future research could utilize a multi-baseline design to design systematic replication across behaviors, situations, and levels of intervention to control additional variables and investigate the causal relationships between independent and dependent variables. Second, one-on-one individual intervention was adopted in this study, which required a significant amount of involvement and energy for the study team to complete the training sessions. In addition, the lack of mutual support between the intervention participants may also weaken the intervention effect. Future studies should attempt to explore the effect of group mindfulness intervention in children at risk for ADHD.

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Appendix

Target Behavior Observation Form

Record: observation of the cases, respectively, for 15 minutes and records, according to the target behavior operation definition, the duration of the case do not focus on behavior in which start time, till the end of this behavior, pause time, when the next target behavior, accumulated in the time of original records, so as to get the target behavior in observation duration.

phase: _____

date: _____

recorder: _____

Subject	Observation Period	Performance of Inattentive Behaviors	Duration of the Target Behaviors	Note

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