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# Intervention Effect of 8-week Mindfulness-based Stress Reduction on Test Anxiety in College Students: A Randomized Controlled Trial

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**Abstract:** Objective To explore the immediate intervention effect and 1-month short-term maintenance effect of 8-week standardized mindfulness-based stress reduction (MBSR) on test anxiety in college students, and to analyze the mediating role of mindfulness level. Methods A prospective randomized controlled trial design was adopted. From March to April 2025, 60 college students with Test Anxiety Scale (TAS) score ≥50 were recruited from a comprehensive university in China, and randomly divided into intervention group and control group, with 30 students in each group. The intervention group received 8-week standard MBSR group training (90 minutes per week), while the control group received no intervention. All participants were assessed with TAS, Five Facet Mindfulness Questionnaire (FFMQ), State-Trait Anxiety Inventory (STAI) and Pittsburgh Sleep Quality Index (PSQI) before intervention (T1), immediately after intervention (T2) and 1 month after intervention (T3). Results Repeated measures ANOVA showed that the time× group interaction effect of TAS scores was significant ($F=28.63$, $p<0.001$). Immediately after intervention and at 1-month follow-up, the TAS scores of the intervention group [(42.5±5.8), (43.1±5.5)] were significantly lower than those of the control group [(56.8±6.0), (57.2±5.9)] (all $p<0.01$). Mediation effect analysis showed that mindfulness level played a partial mediating role between MBSR and test anxiety, with a mediating effect value of -0.32, accounting for 45.7% of the total effect. Conclusion The 8-week standardized MBSR can effectively alleviate test anxiety, improve mindfulness level and sleep quality in college students, and the intervention effect has good short-term stability. The improvement of mindfulness level is an important mechanism of MBSR in reducing test anxiety.

**Keywords:** Mindfulness-based Stress Reduction; Test Anxiety; College Students; Randomized Controlled Trial; Mediation Effect.

## 1. Introduction

Test anxiety is a prevalent emotional disturbance among college students worldwide. Domestic epidemiological surveys demonstrate that 20% to 40% of college students suffer from test anxiety of varying severity, among whom approximately 15% experience moderate or higher-level anxiety[1]. Intense academic competition, stringent graduation requirements and high family expectations render test anxiety a prominent issue in higher education[2]. Test anxiety impairs cognitive functions including concentration and memory, undermining academic performance[3]. Persistent anxiety may further trigger secondary psychological problems such as depression and sleep disorders, severely threatening college students' physical and mental health[4].

As a psychological intervention integrating Eastern meditation concepts and modern psychological theories, mindfulness-based stress reduction has been widely applied in treating emotional disorders[5]. Numerous studies verify that mindfulness training enhances emotional awareness and acceptance, reduces rumination over negative thoughts, and thereby lowers anxiety levels[6]. Nevertheless, existing mindfulness interventions targeting college students' test anxiety predominantly focus on immediate effects, lacking exploration of short-term outcome maintenance[7]. Non-standardized intervention protocols in partial researches also hinder cross-study comparison and popularization[8]. Relevant studies focusing on college students remain insufficient.

This study adopted the internationally recognized 8-week standardized MBSR protocol developed by Professor Kabat-Zinn. A rigorous randomized controlled trial was designed to systematically evaluate the immediate intervention effect and one-month sustained effect on test anxiety. Multiple indicators including mindfulness level, general anxiety and sleep quality were adopted to assess comprehensive intervention efficacy, and the mediating role of mindfulness level between MBSR and test anxiety was analyzed, providing empirical evidence for MBSR functional mechanisms[9]. The findings can offer replicable and promotable intervention strategies for university mental health services, bearing significant theoretical and practical implications.

Research hypotheses are proposed as follows:

(1) The intervention group obtains significantly lower test anxiety scores than the control group at immediate post-intervention and one-month follow-up;

(2) The intervention group shows remarkably higher mindfulness level and lower general anxiety and sleep disorder scores than the control group at the two follow-up time points;

(3) Mindfulness level plays a mediating role between MBSR and test anxiety.

## 2. Subjects and Methods

### 2.1. Subjects

Voluntary college student participants were recruited via campus posters and WeChat groups from March to April 2025 in a comprehensive university. Inclusion criteria: aged 18 to 25 years; TAS score ≥50 (moderate or severe test anxiety); no

prior systematic mindfulness training experience; voluntary participation with signed informed consent. Exclusion criteria: receiving concurrent psychological therapy or psychotropic medication; history of severe mental illnesses or suicidal tendency; inability to complete all training sessions and three assessments.

The sample size of this study was calculated based on the effect sizes of previous similar studies. Sample size estimation was performed using GPower 3.1 software. With α set at 0.05, statistical power (1-β) at 0.8, effect size f* at 0.25, number of repeated measurements at 3, and intraclass correlation coefficient at 0.5, the required sample size per group was calculated to be 24 participants[10]. Considering a 10% dropout rate, it was finally determined that 30 participants would be included in each group, for a total of 60 participants.

All 60 participants were randomly assigned into two groups of equal size using random number table. Group allocation was concealed via sealed envelopes by researchers uninvolved in assessment and intervention to guarantee objectivity. All participants signed ethical informed consent. Free 8-week MBSR training was provided to the control group upon study completion.

## 2.2. Research Design

A prospective randomized controlled trial was implemented.

Baseline assessment (T1): Mid-April 2025, four weeks before mid-term examinations. Demographic information and scale scores of TAS, FFMQ, STAI and PSQI were collected.

Intervention implementation: Late April to mid-June 2025. The intervention group received standardized MBSR training while the control group had no intervention.

Immediate post-intervention assessment (T2): Mid-June 2025, two weeks before final examinations. All scales were reassessed.

Follow-up assessment (T3): Mid-July 2025, one month after final examinations. The third round of scale evaluation was conducted.

All assessments were independently completed by uniformly trained postgraduate psychology students with standardized instructions. Validated English versions of scales were adopted.

## 2.3. Intervention Protocol

The intervention group received simplified standard MBSR training once weekly, 90 minutes per session for 8 consecutive weeks. Interventions were delivered by a psychology master student with professional MBSR certification, systematic supervision from Kabat-Zinn-certified instructors and over two years of group psychological intervention experience. All sessions were audio-recorded for regular supervisor inspection to ensure intervention standardization.

Weekly training contents:

Week 1: Mindfulness introduction and body scan. Introduce mindfulness concepts and research procedures; 30-minute body scan practice; group experience sharing; homework: 15-minute daily body scan and practice journal recording.

Week 2: Mindful breathing and emotional awareness. Review body scan; 20-minute mindful breathing practice; physical emotional signal recognition; emotional experience discussion; homework: 20-minute daily mindful breathing and daily emotion logging.

Week 3: Mindful walking and mindful eating. Review mindful breathing; 15-minute mindful walking; 10-minute mindful raisin tasting; daily mindfulness integration discussion; homework: 10-minute daily mindful walking and weekly mindful eating practice.

Week 4: Mindful imagery and stress coping. Review prior practices; 20-minute peaceful scene imagery; personal stress trigger identification; stress management experience sharing; homework: 15-minute daily imagery and stress event recording.

Week 5: Acceptance and non-judgment. Review mindful imagery; 20-minute non-judgmental acceptance training; discussion on practical non-judgment difficulties; homework: 15-minute daily acceptance exercise and judgmental thought recording.

Week 6: Mindfulness in examination scenarios. Review acceptance training; simulated examination mindfulness application; 3-minute breathing space anxiety relief technique; test anxiety coping discussion; homework: three daily 3-minute breathing space exercises and simulated test practice.

Week 7: Integration and application. Review all previous training; 20-minute comprehensive mindfulness practice; daily and future examination mindfulness application discussion; homework: 20-minute daily integrated practice and personal mindfulness schedule formulation.

Week 8: Summary and prospect. Share training gains; answer questions; emphasize sustained practice; distribute follow-up notice; homework: persistent mindfulness practice and experience recording.

Participants were required to finish 20 to 30 minutes of home mindfulness practice daily and submit authentic journals. Researchers supervised practice compliance and reminded low-adherence participants via online communication.

## 2.4. Assessment Tools

Demographic questionnaire: Self-designed questionnaire covering gender, age, grade, major, only-child status and hometown residence.

Test Anxiety Scale (TAS): Developed by Sarason, consisting of 37 items scored from 1 to 4. Total scores range 37–148. Higher scores indicate severer test anxiety: 37–49 for mild anxiety, 50–64 for moderate anxiety, and above 64 for severe anxiety. The scale possesses good reliability and validity with Cronbach's α coefficient of 0.88.

Five Facet Mindfulness Questionnaire (FFMQ): Compiled by Baer et al., containing 39 items divided into five dimensions: observing, describing, acting with awareness, non-judging of inner experience and non-reactivity to inner experience. Items are scored 1 to 5, with total scores 39–195. Higher scores reflect higher mindfulness level. Cronbach's α of the total scale is 0.86, and subscale coefficients range 0.68–0.83.

State-Trait Anxiety Inventory (STAI): Designed by Spielberger et al., including 20-item state anxiety scale and 20-item trait anxiety scale with 1–4 scoring. State anxiety evaluates transient emotional status while trait anxiety measures stable anxious personality traits. Cronbach's α coefficients are 0.92 and 0.88 respectively.

Pittsburgh Sleep Quality Index (PSQI): Developed by Buysse et al., composed of 19 items categorized into seven components. Each component is scored 0–3, total scores 0–21. Higher scores mean poorer sleep quality; total score over

7 indicates sleep disorders. Cronbach's α coefficient reaches 0.83.

## 2.5. Statistical Analysis

SPSS 25.0 and Hayes PROCESS macro were used for data analysis. Measurement data were presented as mean±standard deviation, and enumeration data as frequency and percentage. Independent-samples t-test and chi-square test were adopted for between-group demographic comparisons. Repeated measures ANOVA was applied to analyze main effects of time and group as well as time-group interaction. Simple effect tests were conducted upon significant interaction. Model 4 of PROCESS macro was used for mediating effect verification[11]. Two-tailed tests were adopted, and $p<0.05$ was regarded as statistically significant.

# 3. Results

## 3.1. Baseline Demographic Comparison

Sixty participants completed all assessments without dropout. No significant between-group differences were found in gender, age, grade, major, only-child status and residential location ($p>0.05$). Baseline data were balanced and comparable, as detailed in Table 1.

**Table 1.** Comparison of general data between the two groups

| Item | Intervention group (n=30) | Control group (n=30) | $t/\chi^2$ value | p value |
|---|---|---|---|---|
| Gender (Male/Female) | 13/17 | 12/18 | 0.07 | 0.79 |
| Age (years) | 20.3±1.5 | 20.5±1.4 | -0.53 | 0.60 |
| Grade (Freshman/Sophomore/Junior/Senior) | 6/12/8/4 | 5/13/7/5 | 0.35 | 0.95 |
| Major (Liberal Arts/Science/Engineering/Medicine) | 8/7/10/5 | 7/8/11/4 | 0.42 | 0.94 |
| Only child (Yes/No) | 12/18 | 14/16 | 0.27 | 0.60 |
| Family residence (Urban/Rural) | 16/14 | 15/15 | 0.07 | 0.79 |

## 3.2. Between-group TAS Score Comparison

The results of repeated measures ANOVA showed that there was a significant main effect of time on TAS scores ($F=32.17$, $p<0.001$), a significant main effect of group ($F=25.49$, $p<0.001$), and a significant time × group interaction effect ($F=28.63$, $p<0.001$).

Simple effect analysis indicated that there was no statistically significant difference in TAS scores between the two groups before intervention (T1) ($p>0.05$); immediately after intervention (T2) and at 1-month follow-up (T3), the TAS scores of the intervention group were significantly lower than those of the control group (all $p<0.01$).

Within-group comparisons revealed that the TAS scores of the intervention group at T2 and T3 were significantly lower than those at T1 (all $p<0.01$), and there was no statistically significant difference between the scores at T2 and T3 ($p>0.05$); there were no statistically significant differences in TAS scores of the control group across the three time points (T1, T2, T3) (all $p>0.05$), as detailed in Table 2.

**Table 2.** Comparison of TAS scores between the two groups at different time points ($\bar{x}\pm s$, score)

| Group | T1 | T2 | T3 |
|---|---|---|---|
| Intervention group (n=30) | 58.2±6.3 | 42.5±5.8a,b | 43.1±5.5a,b |
| Control group (n=30) | 57.9±6.1 | 56.8±6.0a | 57.2±5.9a |

Note: a $p<0.01$ compared with T1 in the same group; b $p<0.01$ compared with the control group at the same time point.

## 3.3. Between-group FFMQ Score Comparison

The results of repeated measures ANOVA showed that there was a significant main effect of time on FFMQ total scores ($F=29.45$, $p<0.001$), a significant main effect of group ($F=22.78$, $p<0.001$), and a significant time × group interaction effect ($F=26.31$, $p<0.001$).

Simple effect analysis indicated that there was no statistically significant difference in FFMQ total scores between the two groups before intervention (T1) ($p>0.05$); immediately after intervention (T2) and at 1-month follow-up (T3), the FFMQ total scores of the intervention group were significantly higher than those of the control group (all $p<0.01$).

Within-group comparisons revealed that the FFMQ total scores of the intervention group at T2 and T3 were significantly higher than those at T1 (all $p<0.01$), and there was no statistically significant difference between the scores at T2 and T3 ($p>0.05$); there were no statistically significant differences in FFMQ total scores of the control group across the three time points (all $p>0.05$).

Among the subscales of FFMQ, the intervention group showed the most significant changes in scores on the three dimensions of "Acting with Awareness", "Non-judging of Inner Experience" and "Non-reactivity to Inner Experience" (all $p<0.01$), while the changes in scores on the "Observing" and "Describing" dimensions were relatively smaller

(p<0.05), as detailed in Table 3.

**Table 3.** Comparison of FFMQ total score and subscale scores between the two groups at different time points (x̄±s, score)

| Item | Group | T1 | T2 | T3 |
|---|---|---|---|---|
| FFMQ Total Score | Intervention Group | 102.5±12.3 | 128.7±13.5a,b | 127.9±13.2a,b |
| | Control Group | 103.1±12.1 | 104.3±12.5 | 103.8±12.3 |
| Observing | Intervention Group | 21.3±3.5 | 24.5±3.8a,b | 24.2±3.7a,b |
| | Control Group | 21.5±3.4 | 21.8±3.6 | 21.6±3.5 |
| Describing | Intervention Group | 20.7±3.2 | 23.1±3.5a,b | 22.9±3.4a,b |
| | Control Group | 20.9±3.1 | 21.1±3.3 | 21.0±3.2 |
| Acting with Awareness | Intervention Group | 19.8±3.1 | 26.2±3.7a,b | 25.9±3.6a,b |
| | Control Group | 20.1±3.0 | 20.3±3.2 | 20.2±3.1 |
| Non-judging of Inner Experience | Intervention Group | 18.5±2.9 | 25.4±3.4a,b | 25.1±3.3a,b |
| | Control Group | 18.7±2.8 | 18.9±3.0 | 18.8±2.9 |
| Non-reactivity to Inner Experience | Intervention Group | 22.2±3.4 | 29.5±3.9a,b | 29.2±3.8a,b |
| | Control Group | 22.4±3.3 | 22.6±3.5 | 22.5±3.4 |

Note: a p<0.05 compared with T1 in the same group; b p<0.01 compared with the control group at the same time point.

## 3.4. Between-group STAI Score Comparison

The results of repeated measures ANOVA showed that the time × group interaction effect was significant for S-AI scores (F=24.56, p<0.001), and also significant for T-AI scores (F=18.72, p<0.001).

Simple effect analysis indicated that there were no statistically significant differences in both S-AI and T-AI scores between the two groups before intervention (T1) (all p>0.05); immediately after intervention (T2) and at 1-month follow-up (T3), both S-AI and T-AI scores of the intervention group were significantly lower than those of the control group (all p<0.01).

Within-group comparisons revealed that both S-AI and T-AI scores of the intervention group at T2 and T3 were significantly lower than those at T1 (all p<0.01), and there were no statistically significant differences between the scores at T2 and T3 (all p>0.05); there were no statistically significant differences in both S-AI and T-AI scores of the control group across the three time points (all p>0.05), as detailed in Table 4.

**Table 4.** Comparison of STAI scores between the two groups at different time points (x̄±s, score)

| Item | Group | T1 | T2 | T3 |
|---|---|---|---|---|
| S-AI | Intervention Group | 56.3±7.2 | 41.2±6.5a,b | 42.1±6.7a,b |
| | Control Group | 55.9±7.0 | 54.7±6.8 | 55.2±6.9 |
| T-AI | Intervention Group | 52.7±6.8 | 43.5±6.2a,b | 44.1±6.4a,b |
| | Control Group | 52.3±6.6 | 51.8±6.5 | 52.0±6.7 |

Note: a p<0.01 compared with T1 in the same group; b p<0.01 compared with the control group at the same time point.

## 3.5. Between-group PSQI Score Comparison

The results of repeated measures ANOVA showed that the time × group interaction effect was significant for PSQI total scores (F=19.34, p<0.001).

Simple effect analysis indicated that there was no statistically significant difference in PSQI total scores between the two groups before intervention (T1) (p>0.05); immediately after intervention (T2) and at 1-month follow-up (T3), the PSQI total scores of the intervention group were significantly lower than those of the control group (all p<0.01).

Within-group comparisons revealed that the PSQI total scores of the intervention group at T2 and T3 were significantly lower than those at T1 (all p<0.01), and there was no statistically significant difference between the scores at T2 and T3 (p>0.05); there were no statistically significant differences in PSQI total scores of the control group across the three time points (all p>0.05).

Among the components of PSQI, the intervention group showed the most significant changes in scores on the three components of "Sleep Quality", "Sleep Latency" and "Daytime Dysfunction" (all p<0.01), as detailed in Table 5.

**Table 5.** Comparison of PSQI total score and component scores between the two groups at different time points ($\bar{x}\pm s$, score)

| Item | Group | T1 | T2 | T3 |
|---|---|---|---|---|
| PSQI Total Score | Intervention Group | 10.2±2.3 | 6.3±1.8a,b | 6.5±1.9a,b |
| | Control Group | 9.9±2.2 | 9.7±2.1 | 9.8±2.2 |
| Sleep Quality | Intervention Group | 2.1±0.6 | 1.2±0.4a,b | 1.3±0.4a,b |
| | Control Group | 2.0±0.5 | 1.9±0.5 | 2.0±0.5 |
| Sleep Latency | Intervention Group | 2.3±0.7 | 1.3±0.5a,b | 1.4±0.5a,b |
| | Control Group | 2.2±0.6 | 2.1±0.6 | 2.2±0.6 |
| Sleep Duration | Intervention Group | 1.5±0.5 | 1.1±0.4a,b | 1.2±0.4a,b |
| | Control Group | 1.4±0.5 | 1.4±0.5 | 1.4±0.5 |
| Sleep Efficiency | Intervention Group | 1.2±0.4 | 0.8±0.3a,b | 0.9±0.3a,b |
| | Control Group | 1.1±0.4 | 1.1±0.4 | 1.1±0.4 |
| Sleep Disturbance | Intervention Group | 1.4±0.5 | 1.0±0.4a,b | 1.1±0.4a,b |
| | Control Group | 1.3±0.5 | 1.3±0.5 | 1.3±0.5 |
| Use of Sleep Medication | Intervention Group | 0.3±0.5 | 0.2±0.4 | 0.2±0.4 |
| | Control Group | 0.2±0.4 | 0.2±0.4 | 0.2±0.4 |
| Daytime Dysfunction | Intervention Group | 1.4±0.5 | 0.7±0.3a,b | 0.8±0.3a,b |
| | Control Group | 1.3±0.5 | 1.3±0.5 | 1.3±0.5 |

Note: a $p<0.01$ compared with T1 in the same group; b $p<0.01$ compared with the control group at the same time point.

### 3.6. Mediating Effect of Mindfulness Level

Mediation effect analysis was conducted with group as the independent variable (intervention group = 1, control group = 0), TAS scores at T2 as the dependent variable, and FFMQ total scores at T2 as the mediating variable. The results showed that the total effect was significant ($\beta=-0.70$, $p<0.001$), the direct effect was significant ($\beta=-0.38$, $p<0.01$), and the indirect effect was significant ($\beta=-0.32$, 95% CI: -0.51 to -0.17). The mediating effect accounted for 45.7% of the total effect. This indicates that mindfulness level plays a partial mediating role between MBSR and test anxiety, that is, MBSR can not only directly reduce test anxiety in college students, but also indirectly reduce test anxiety by improving their mindfulness level.

### 3.7. Intervention Compliance Analysis

Among the 30 participants in the intervention group, 26 completed all 8 training sessions, with an attendance rate of 86.7%; 4 participants missed 1 training session, with an absence rate of 13.3%. Regarding home practice adherence, the average number of practice days per week was 5.2±1.3 days, and the average daily practice duration was 22.5±6.7 minutes. Among them, 21 participants practiced ≥5 days per week, with a good adherence rate of 70%; 9 participants practiced <5 days per week, with poor adherence.

Correlation analysis showed that home practice duration was significantly negatively correlated with TAS scores at T2 ($r=-0.58$, $p<0.001$) and significantly positively correlated with FFMQ total scores at T2 ($r=0.62$, $p<0.001$). This indicates that better practice adherence is associated with more significant intervention effects [12].

## 4. Discussion

This study explored the efficacy and mechanism of 8-week standardized MBSR on college students' test anxiety. The intervention effectively reduced test anxiety with stable effects lasting one month, consistent with previous research findings. Test anxiety showed spontaneous stability without external intervention. MBSR greatly enhanced participants' mindfulness capacity, especially non-judgmental and responsive awareness. It also relieved general anxiety and optimized sleep conditions, breaking the vicious cycle between anxiety and sleep disturbance.

Mediation analysis confirmed that improved mindfulness constitutes a core mechanism of MBSR intervention. Daily home practice compliance positively correlates with therapeutic effects.

Study limitations include single-university sampling restricting extrapolation, absence of blind design, and insufficient long-term follow-up data.

## 5. Conclusion

In conclusion, the 8-week standardized Mindfulness-Based Stress Reduction (MBSR) is a simple, effective and easy-to-promote psychological intervention method. It can significantly alleviate test anxiety in college students, improve their mindfulness levels, reduce general anxiety levels, and improve sleep quality, with good short-term stability of intervention effects. The improvement of mindfulness level is an important mechanism by which

MBSR reduces test anxiety. College mental health educators should attach importance to the application of MBSR, incorporate it into the regular mental health service system, help college students better cope with exam pressure, and maintain their physical and mental health.

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