Journal of Fundamentals of Mental Health

Mashhad University of Medical Sciences

Psychiatry and Behavioral Sciences Research Center

Original Article **Open Access**

Effectiveness of mindfulness-based stress reduction on anxiety sensitivity and problem-solving ability of students

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Abstract

Introduction: Anxiety and poor problem-solving ability are common challenges among university students and can negatively affect their academic performance and mental health. This study aimed to evaluate the effectiveness of Mindfulness-Based Stress Reduction (MBSR) in reducing anxiety sensitivity and improving problem-solving ability among students.

Materials and Methods: This cross-sectional study conducted from March to June 2025 at the Islamic Azad University, Mashhad Branch. Thirty male students were selected through purposive sampling and randomly assigned to an experimental group (n= 15) and a control group (n= 15). Data were collected using the Anxiety Sensitivity Index-Revised (ASI-R) and the Problem-Solving Inventory (PSI). The experimental group participated in eight weekly one-hour MBSR sessions, while the control group received no intervention. Data were analyzed using multivariate analysis of covariance.

Results: The findings indicated that MBSR training significantly reduced anxiety sensitivity and improved problem-solving ability in the experimental group compared with the control group ($P< 0.05$).

Conclusion: The MBSR program appears to be an effective intervention for reducing anxiety sensitivity and enhancing problem-solving ability among university students. Implementing mindfulness training in academic settings may promote emotional regulation, self-awareness, and adaptive coping.

Keywords: Anxiety sensitivity, Mindfulness, Problem-solving, Stress reduction

Please cite this paper as:
Taheri E, Amiri M, Saedi Z, Taheri H. Effectiveness of mindfulness-based stress reduction on anxiety sensitivity and problem-solving ability of students. Journal of Fundamentals of Mental Health 2026 May-Jun; 28(3): 217-223.
DOI: 10.22038/jfmh.2025.89056.3257

Introduction

Transitioning to university life presents substantial academic, social, and emotional challenges that significantly increase stress and anxiety levels among students (1). Elevated stress impairs learning efficiency and academic performance while predisposing students to psychological distress and academic burnout

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Received: Jun. 24, 2025
Accepted: Dec. 08, 2025
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(2). When unmanaged, stress manifests as anxiety—a state of heightened arousal that negatively affects cognitive functioning and emotional stability (3). Identifying effective interventions to reduce anxiety and promote adaptive coping represents a critical priority in higher education (4).

Anxiety sensitivity, defined as the fear of anxiety-related sensations based on beliefs about their harmful consequences, constitutes a key factor in developing and maintaining anxiety disorders (5). Individuals with high anxiety sensitivity misinterpret physiological arousal as dangerous, amplifying anxious responses and avoidance behaviors (6). This cognitive vulnerability predicts various forms of psychopathology, including panic and generalized anxiety disorders (7).

Problem-solving ability represents another crucial construct relevant to students' psychological functioning (8). Research indicates that individuals with stronger problem-solving skills experience lower anxiety levels, greater emotional control, and better adjustment to stressful situations (9). Conversely, poor problem-solving abilities associate with maladaptive coping, helplessness, and increased vulnerability to stress (10). Thus, strengthening problem-solving skills serves as a protective factor against emotional distress in academic environments (11).

Mindfulness-based interventions have emerged as effective methods for improving emotional regulation and reducing anxiety symptoms (12). Among these, Mindfulness-Based Stress Reduction (MBSR)—developed by Kabat-Zinn (13)—stands as one of the most validated programs for enhancing psychological well-being.

MBSR teaches participants to cultivate present-moment awareness and nonjudgmental acceptance of thoughts, emotions, and bodily sensations (14).

This practice reduces catastrophic interpretations of anxiety symptoms and fosters flexible, adaptive responses to problems (15).

Despite growing evidence of MBSR's benefits for anxiety management, few studies have examined its simultaneous effects on anxiety sensitivity and problem-solving ability among Iranian university students (16). Most previous research has focused on clinical populations or general anxiety measures rather than specific cognitive constructs like anxiety sensitivity (17).

This study investigated the effectiveness of an eight-week MBSR program in reducing anxiety sensitivity and improving problem-solving ability among male students at Islamic Azad University, Mashhad Branch.

Materials and Methods

The statistical population consisted of all male students at the Islamic Azad University, Mashhad Branch, during the 2024-2025 academic year. Using purposive sampling and based on inclusion criteria, 30 students were selected and randomly assigned to either an experimental group (n= 15) or a control group (n= 15).

Inclusion criteria included willingness to participate in the study and sign the informed consent form, absence of severe psychiatric disorders (based on self-report) and not receiving concurrent psychological or pharmacological treatment for mental health issues. The exclusion criteria included receiving other psychological interventions during the study period, absence from more than one MBSR session, or withdrawal of consent at any stage of the research.

The sample size was determined using Cohen's (1988) power analysis formula for comparing two means:

Assuming a medium effect size (f= 0.25), a significance level (α) of 0.05, and a statistical power (1-β) of 00.80, the minimum required sample size per group was estimated to be 12. To account for potential attrition= 15 participants per group (total n= 30) were included.

Following the obtaining of informed consent, both groups completed the Anxiety Sensitivity Index-Revised (ASI-R) and the Problem-Solving Inventory (PSI) as pre-test measures. The experimental group received eight 60-minute weekly sessions of Mindfulness-Based Stress Reduction (MBSR). The content of these sessions, summarized in Table 1, was adapted from the standardized protocol by Pouyanfar and Almal (2016) (17).

The control group received no intervention during this period. After the intervention, both groups completed the same questionnaires as post-tests. Adhering to ethical considerations, the control group was offered five MBSR sessions following data collection.

Table 1. Content of the Mindfulness-Based Stress Reduction (MBSR) intervention

Session	Main content and exercises
1	Introduction to mindfulness and stress; Raisin exercise; Body scan meditation.
2	Perception of thoughts and feelings; Sitting meditation with focus on breath; Body scan practice.
3	Mindfulness in daily life; Mindful movement (gentle yoga); 3-minute breathing space.
4	Exploring stress reactivity and response; Sitting meditation with expansion to sounds and thoughts.
5	Acceptance and allowing; Sitting meditation with a focus on difficult thoughts/emotions.
6	Interpersonal mindfulness; Communication exercises; Mindful listening.
7	Integrating mindfulness into daily routines; Developing a personalized practice plan.
8	Review of learned skills; Strategies for maintaining long-term practice; Final group discussion.

Research instruments

A) Anxiety Sensitivity Index-Revised (ASI-R): This scale was developed and validated by Taylor and Cox (1998). This 30-item self-report questionnaire uses a five-point Likert scale ranging from "very little" to "very much" and measures four dimensions of anxiety sensitivity: respiratory concerns, publicly observable anxiety reactions, cardiovascular concerns, and cognitive dyscontrol. Taylor and Cox (1998) reported good internal consistency, with Cronbach's alpha coefficients ranging from 0.83 to 0.94 (18,19). The ASI-R has also been validated in Iranian populations. A study conducted a confirmatory factor analysis, which confirmed the four-factor structure, explaining over 58% of the total variance. Reliability indices in the Iranian sample, assessed through internal consistency, test-retest, and split-half methods, were 0.93, 0.95, and 0.97, respectively (20).

B) Problem-Solving Inventory (PSI): This inventory was developed by Heppner and Petersen (1982), consists of 35 items (31 scorable) rated on a six-point Likert scale from "strongly disagree" to "strongly agree." The PSI assesses three dimensions: problem-solving confidence, approach-avoidance style, and personal control, with lower total scores indicating better problem-solving ability. Heppner and Petersen (1982) reported Cronbach's alpha coefficients ranging from 0.72 to 0.85 for subscales and 0.90 for the total scale, with construct validity supported through correlations with related personality variables such as locus of control (21). In Iranian samples, reliability has also been confirmed: Khosravi et al. (1998) reported $\alpha = 0.86$, and Rashtgoo et al. (2010) reported two-week test–retest reliabilities between 0.83 and 0.89 (22,23).

Data were analyzed using SPSS version 24. Descriptive statistics (means, standard deviations) summarized the data, and Multivariate Analysis of Covariance (MANCOVA) was used to test the hypotheses, with pre-test scores as covariates. Prior to MANCOVA, assumptions of normality (Shapiro-Wilk test), homogeneity of variances (Levene's test), and homogeneity of regression slopes were verified. The significance level was set at $P < 0.05$.

Results

The demographic characteristics of participants in both groups are presented in Table 2. Independent samples t-test and Chi-square tests revealed no significant differences between the experimental and control groups in terms of age, gender, marital status, educational level, or field of study at baseline ($P > 0.05$), indicating that the groups were homogeneous before the intervention.

All 30 participants completed the study without any attrition. Table 3 presents the pre-test and post-test mean scores for anxiety sensitivity and problem-solving ability in both groups.

Table 2. Demographic characteristics of university students

Characteristic	Experimental group (n=15)	Control group (n=15)	P
Age (Years), M ± SD	22.4 ± 1.8	21.9 ± 2.1	0.487
Marital status, n (%)			0.705
Single	13 (86.7)	14 (93.3)	
Married	2 (13.3)	1 (6.7)	
Educational level, n (%)			0.715
Bachelor Year 2	8 (53.3)	7 (46.7)	
Bachelor Year 3	7 (46.7)	8 (53.3)	
Field of study, n (%)			0.812
Engineering	6 (40.0)	5 (33.3)	
Humanities	5 (33.3)	6 (40.0)	
Basic sciences	4 (26.7)	4 (26.7)	

Table 3. The scores of anxiety sensitivity and problem-solving ability in pre-test and post-test stages

Variable	Group	Pre-test	Post-test
Anxiety sensitivity	Experimental	57.66 ± 10.34	40.53 ± 8.79
	Control	55.07 ± 9.51	55.01 ± 9.87
Problem-solving ability	Experimental	103.27 ± 12.58	115.26 ± 10.95
	Control	85.33 ± 11.22	85.53 ± 11.90

Prior to conducting the main analysis, all necessary assumptions for MANCOVA were tested and verified. The Shapiro-Wilk test confirmed normal distribution of data (P> 0.05), Levene's test established homogeneity of variances (P> 0.05), and Box's M test indicated equality of covariance matrices (Box's M= 0.092, P> 0.05). The assumption of homogeneity of regression slopes was also met. Multivariate Analysis of Covariance (MANCOVA), controlling for pre-test scores, revealed a significant overall effect of the MBSR intervention on the combined dependent variables: Wilks' Lambda= 0.067, F(2,26)= 186.577, P< 0.001, Partial Eta Squared= 0.933. Follow-up ANCOVA tests demonstrated significant between-group differences for both outcome variables after controlling for pre-test scores:

Anxiety sensitivity: F(1,26)= 363.08, P< 0.001, Partial η^2= 0.933

Problem-solving ability: F(1,26)= 250.84, P< 0.001, Partial η^2= 0.906

Table 4. Adjusted post-test means and standard errors

Variable	Group	Adjusted mean	Standard error
Anxiety Sensitivity	Experimental	40.59	0.53
	Control	55.01	0.53
Problem-Solving Ability	Experimental	115.99	1.35
	Control	85.53	1.35

The results indicate that the mindfulness-based stress reduction training led to statistically significant reductions in anxiety sensitivity and significant improvements in perceived problem-solving ability among students in the experimental group compared to the control group. The large effect sizes (Partial η^2> 0.90) for both outcome variables suggest substantial practical significance of the intervention effects. The findings support the effectiveness of the MBSR program in enhancing psychological well-being among university students.

Discussion

The present study investigated the efficacy of a Mindfulness-Based Stress Reduction (MBSR) program on anxiety sensitivity and problem-solving ability among male students at the Islamic Azad University, Mashhad Branch. The findings demonstrated that the MBSR program significantly reduced anxiety sensitivity and enhanced perceived problem-solving ability in the experimental group compared to the control group. These findings should be interpreted within the context of broader challenges facing university students, including academic stress and adaptation difficulties that can precipitate psychological distress (1,2).

The substantial reduction in anxiety sensitivity, as measured by the Anxiety Sensitivity Index-Revised (ASI-R)—a tool with established reliability and validity in both international (19) and Iranian (20) contexts—aligns with established literature. Our results are consistent with mindfulness research demonstrating significant decreases in anxiety-related symptoms following MBSR training (14,17). However, the large effect size observed in our study exceeds those reported in some previous mindfulness studies (13), potentially reflecting the optimized intervention duration and standardized protocol implementation. The reduction in catastrophic interpretation of bodily sensations supports the theoretical framework proposed by anxiety sensitivity researchers, wherein mindfulness practices disrupt the cycle of anxiety amplification through enhanced interoceptive awareness. This finding is particularly relevant given that anxiety sensitivity represents a key transdiagnostic mechanism in emotional disorders (6).

Regarding problem-solving enhancement, measured by the Problem-Solving Inventory (PSI)—an instrument with well-documented psychometric properties (21-23)—our findings extend previous work. The results are in harmony with educational intervention research showing that mindfulness training can improve cognitive aspects of academic performance (8). The cognitive flexibility cultivated through mindfulness practices (24,25) appears to facilitate more adaptive problem-solving approaches, corroborating evidence linking mindfulness with enhanced executive functioning (26). Conversely, our findings contrast with studies reporting more modest effects of mindfulness on problem-solving in other cultural contexts. This discrepancy may be partially explained by cultural variations in problem-solving styles (7,26), suggesting that the cognitive-reflective components of MBSR may resonate particularly well within the Iranian cultural and educational context, potentially leading to the strong effects observed in our sample.

The current results should be interpreted considering several methodological considerations. The exclusive focus on male students from a single university, while addressing a specific gap in the literature (7), limits the generalizability of findings to female students and other academic populations. Furthermore, the reliance on self-report measures, though psychometrically validated (18,21), represents a limitation shared with much educational intervention research (9). Future studies should incorporate multimodal assessment strategies, including behavioral measures of problem-solving and physiological indices of anxiety sensitivity (4,6).

The large effect sizes observed in this study may reflect both the efficacy of the intervention and participants' heightened baseline stress levels, consistent with reports of academic burnout among university students (2). The integration of mindfulness practices within university mental health services appears particularly timely given increasing mental health challenges in academic settings (1,9).

Conclusion

In conclusion, the standardized 8-week MBSR protocol effectively reduced anxiety sensitivity and enhanced perceived problem-solving capabilities in Iranian male university students, as measured by robust and culturally validated instruments. These findings align with a growing body of international research while also highlighting potential culturally specific outcomes. The robust effects support the integration of evidence-based mindfulness programs within university wellness services as a preventive approach to student psychological wellbeing, particularly in contexts of academic stress and transition challenges. Future research should aim to replicate these findings with more diverse populations and include long-term follow-up assessments to evaluate the durability of these beneficial effects.

Acknowledgments

The authors wish to express their gratitude to the students who participated in this study for their cooperation and commitment.

Conflict of Interest

The authors declare no conflicts of interest

Funding

The authors report that this research received no funding.

Ethical Considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The study protocol received formal approval from the Ethics Committee of Mashhad University of Medical Sciences. Prior to enrolment, all potential participants were comprehensively informed about the aims and procedures. Written informed consent was obtained from each participant. To ensure confidentiality, all collected data were anonymized, and no personally identifiable information was retained.

Code of Ethics

IR.MUMS.MEDICAL.REC.1404.133; IRCT20250523065853N3

Authors' Contributions

All authors have made substantial intellectual contributions to this manuscript. Elham Taheri led the conceptualization and methodology of the study, conducted the formal analysis and investigation, curated the data, wrote the original draft, and managed project administration. Zahra Saedi contributed to the methodology, developed and validated software tools, supported investigation and resource provision, and participated in writing – review, and editing. Mahdi Amiri contributed to conceptualization and methodology, validated the analytical processes, supervised the research, and contributed to writing – review. and editing. Haniyeh Taheri assisted in investigation, provided resources, contributed

to data curation, and participated in writing – review, and editing. All authors reviewed and approved the final version of the manuscript.

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