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Research Article

The Effectiveness of Mindfulness-Based Stress Reduction on Worry, Cognitive Distortions, and Depression in Students with Insomnia Symptoms

Roghayeh Vatanbaf[1], Faezeh Moslemi[2], Saba Azizrousta[3], Faranak Saeidi Moghadam[4], Vahid Savabi Niri[5]

1.. M.A. in Educational Psychology, Tabriz University, Tabriz, Iran
2. M.A. in General Psychology, Tabriz Branch, Islamic Azad University, Tabriz, Iran
3. M.A. in Clinical Psychology, Ardabil Branch, Islamic Azad University, Ardabil, Iran
4. M.A. in General Psychology, Zarrinshahr Branch, Payame Noor University, Zarrinshahr, Iran
5. M.A. in Clinical Psychology, Ardabil Branch, Islamic Azad University, Ardabil, Iran

Correspondence:

Vahid Savabi Niri

Email:

v.savabi@gmail.com

Abstract

Objective: Insomnia, marked by difficulty falling or staying asleep, affects many students and contributes to increased worry, cognitive distortions, and depression, exacerbating their overall well-being and academic performance. This study evaluates the effectiveness of Mindfulness-Based Stress Reduction (MBSR) in reducing worry, cognitive distortions, and depression in students with insomnia symptoms.

Method: The research utilized a quasi-experimental design with a pretest-posttest control group. The statistical population consisted of university students in Ardabil Province during the 2023-2024 academic year. A total of 34 students were purposefully selected based on predefined criteria (e.g., insomnia symptoms) and then randomly assigned to either the intervention group (n = 17) or the control group (n = 17). The research instruments included the Insomnia Severity Index (2001), the Penn State Worry Questionnaire (1990), the Cognitive Distortions Questionnaire (2004), and the Beck Depression Inventory (1996). The intervention group participated in eight weekly sessions of 90-minute MBSR, while the control group received no intervention. Data were analyzed using multivariate analysis of covariance with SPSS-27.

Results: The results indicated that MBSR significantly reduced worry ($F = 46.86$), rejection in interpersonal relationships ($F = 30.07$), unrealistic expectations in relationships ($F = 41.54$), misperception in interpersonal relationships ($F = 30.38$), and depression ($F = 41.20$) among students with insomnia symptoms ($P < 0.001$).

Conclusion: The results highlight the potential of MBSR as a valuable non-pharmacological intervention for managing insomnia and associated psychological challenges in academic settings. Given its effectiveness, further research could explore long-term benefits and applicability across diverse student populations and settings.

Keywords: Cognitive Distortions, Depression, Insomnia, Mindfulness, Mental Health.

How to Cite

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Extended Abstract

Background and Objectives

Insomnia is a widespread issue among students, driven by academic stress, irregular sleep schedules, excessive screen time, and social pressures, leading to cognitive impairment, emotional distress, and reduced overall well-being. Persistent worry and cognitive distortions exacerbate sleep disturbances by fueling anxiety and negative thought patterns, creating a vicious cycle where poor sleep intensifies mental distress, which in turn disrupts sleep. Moreover, insomnia and depression are closely linked, with each condition reinforcing the other, further impairing students' ability to cope with daily stressors. Given these challenges, Mindfulness-Based Stress Reduction (MBSR) has emerged as an effective non-pharmacological intervention, offering techniques such as mindfulness meditation, body awareness, and gentle movement to promote relaxation and reduce hyperarousal. By fostering present-moment awareness and helping students disengage from negative thoughts, MBSR breaks the cycle of worry, cognitive distortions, and depression that perpetuate insomnia. Research highlights its effectiveness in improving sleep quality, reducing anxiety, and enhancing emotional resilience, making it a valuable tool for student wellness programs aimed at addressing sleep disturbances and mental health concerns. This study examines the effectiveness of MBSR in reducing worry, cognitive distortions, and depression in students with insomnia symptoms.

Materials and Method

This study employed a quasi-experimental pretest-posttest control group design to assess the effectiveness of Mindfulness-Based Stress Reduction (MBSR) in reducing worry, cognitive distortions, and depression among students with insomnia symptoms. The research population comprised university students in Ardabil Province during the 2023-2024 academic year. A total of 34 participants were purposefully selected based on Insomnia Severity Index (ISI) scores above 15 and randomly assigned through a lottery method to either the intervention group (n=17) or the control group (n=17). The required sample size for quasi-experimental studies was calculated considering an effect size of 2.5 (d), 90% statistical power, a significance level of 0.05, and a standard deviation (σ) of 7.63, with additional participants included to account for potential dropouts. Participants met the inclusion criteria, such as obtaining the required ISI cutoff score, providing full consent, and not participating in other psychological interventions. Exclusion criteria included incomplete questionnaire responses or missing more than two intervention sessions. Ethical guidelines were strictly followed, ensuring confidentiality, voluntary participation, and data usage exclusively for research purposes. The study adhered to the Committee on Publication Ethics (COPE) and the Helsinki Declaration, maintaining integrity and transparency in research practices. The intervention group received the MBSR training program by Chaskalson (2011), conducted over eight weekly 90-minute sessions, while the control group remained on a waiting list. Both groups underwent pretest and posttest assessments using validated research instruments, including the Insomnia Severity Index (2001), the Penn State Worry Questionnaire (1990), the Cognitive Distortions Questionnaire (2004), and the Beck Depression Inventory (1996). Data were analyzed using SPSS-27, applying descriptive statistics (mean, standard deviation, tables) and multivariate analysis of covariance (MANCOVA) for inferential analysis. Findings were examined at both descriptive and statistical levels to assess the impact of MBSR on insomnia-related symptoms and associated psychological factors.

Results

The intervention and control groups showed no significant differences in demographic variables, including age, gender, marital status, education level, and sleep duration ($P>0.05$). The homogeneity of variance assumption was confirmed for worry, cognitive distortions, and depression ($P>0.05$), as well as the equality of covariance matrices (Box M = 17.01, F = 0.94, $P>0.05$). The Chi-Square-Bartlett test demonstrated a significant association between worry, cognitive distortions, and depression ($\chi^2=134.16$, df=14, $P<0.05$). Additionally, the homogeneity of regression coefficients was upheld ($F=0.901$, $P=0.342$). The results confirmed a significant effect of MBSR on worry, cognitive distortions, and depression, with 68% of the variance between the experimental and control groups attributed to the intervention. The test's statistical power was 1, indicating an adequate sample size. The F-statistic showed a significant impact of MBSR on

worry (F=46.86), rejection in interpersonal relationships (F=30.07), unrealistic expectations in relationships (F=41.54), misperception in interpersonal relationships (F=30.38), and depression (F=41.20) at P<0.001. Effect size analysis indicated that MBSR accounted for 63% of the variance in worry, 52% in rejection in interpersonal relationships, 61% in unrealistic expectations in relationships, 53% in misperception in interpersonal relationships, and 60% in depression. These findings highlight MBSR as an effective intervention in reducing worry, cognitive distortions, and depression among students with insomnia symptoms.

Discussion and Conclusion

The findings revealed that MBSR significantly decreased worry, aligning with previous research demonstrating mindfulness's role in managing stress and anxiety. By promoting present-moment awareness, MBSR helps students disengage from rumination and intrusive thoughts that often lead to sleep disturbances. This reduction in worry is crucial for improving relaxation and sleep quality while also lowering physiological arousal. Additionally, MBSR enhances emotional regulation, enabling students to better manage academic and personal stressors. These results reinforce the bidirectional relationship between worry and insomnia, emphasizing the importance of mindfulness-based interventions in breaking this cycle. The study also found that MBSR effectively reduced cognitive distortions and depressive symptoms. Cognitive distortions, such as catastrophizing and overgeneralizing, contribute to stress and anxiety, making sleep more difficult. MBSR's emphasis on mindfulness and non-judgmental awareness helps students recognize and challenge these maladaptive thought patterns, fostering a more balanced perspective. Similarly, depression, which often coexists with insomnia, was significantly reduced following MBSR, suggesting improvements in emotional well-being. By reducing stress and promoting relaxation, MBSR mitigates symptoms of depression while also improving sleep quality. These findings support the integration of mindfulness-based interventions into student wellness programs as a non-pharmacological approach to managing insomnia and mental health challenges. The study's small sample size and purposeful sampling may limit generalizability and introduce selection bias, while the short intervention duration and reliance on self-report measures restrict the assessment of long-term effects. Future research should include larger, more diverse samples, employ objective measures, and conduct long-term follow-ups to evaluate the sustained impact of MBSR and compare its effectiveness with other interventions

Introduction

Insomnia, a prevalent sleep disorder characterized by persistent difficulties in falling or staying asleep and achieving restorative rest, has emerged as a major concern among students (Gardani et al., 2022). Various factors contribute to disrupted sleep patterns in this population, including academic stress, inconsistent sleep schedules, prolonged screen exposure, and social demands (Shakeel et al., 2019). Research indicates that a significant number of students regularly experience insomnia-related symptoms, such as prolonged sleep latency, frequent nighttime awakenings, and early morning arousal, often leaving them feeling unrested despite a complete night's sleep (Carrión-Pantoja et al., 2022; Chowdhury et al., 2020). Beyond its nighttime effects, insomnia impairs students' daytime functioning, influencing cognitive performance, emotional regulation, and overall well-being. Sleep deprivation has been linked to reduced concentration, memory difficulties, heightened irritability, anxiety, and a greater vulnerability to depression (Chan et al., 2020).

A significant contributor to insomnia is persistent worry, a psychological state characterized by repetitive and uncontrollable negative thoughts. Excessive worry can interfere with sleep initiation and maintenance, creating a vicious cycle where sleep deprivation further intensifies anxious thoughts (Kalmbach et al., 2019). This ongoing mental distress negatively impacts multiple aspects of a student's life, including academic performance, emotional stability, and sleep quality (Ballesio et al., 2021). Studies have consistently shown that students experiencing high levels of worry are more prone to insomnia, highlighting the intricate and

bidirectional relationship between these conditions (Wallsten et al., 2023; Scotta, Cortez, & Miranda, 2022). Students often face unique stressors, including academic pressure, social challenges, financial concerns, and future uncertainties, which can fuel excessive worry (Menghini et al., 2023). This heightened state of anxiety can make it difficult for students to relax at bedtime, leading to prolonged sleep latency, frequent awakenings, and overall poor sleep quality. Worrying at night activates the body's stress response, increasing physiological arousal and preventing the mind from winding down, thus directly contributing to insomnia symptoms (Lindsay et al., 2022).

Insomnia is often worsened by cognitive distortions, as these irrational and negative thought patterns heighten stress and disrupt relaxation, making it more difficult to fall and stay asleep. By shaping how individuals perceive and respond to stressors, cognitive distortions further contribute to sleep disturbances and emotional distress (Jansson-Fröjmark et al., 2024). Among students, these distorted ways of thinking—such as catastrophizing, overgeneralizing, and all-or-nothing thinking—can have a profound impact on mental health, particularly on sleep (Akram et al., 2021). Students prone to cognitive distortions may find themselves trapped in unhelpful thought patterns that heighten anxiety and worry, especially at night (Tang et al., 2023). For instance, thoughts like "If I don't sleep well, I'll fail my exams" or "I'll never be able to cope with my workload" can amplify stress, making it harder to relax and fall asleep (Badawy, 2024). These maladaptive thought processes contribute to increased mental arousal, which interferes with the natural sleep cycle, leading to insomnia symptoms such as prolonged sleep onset, frequent awakenings, and non-restorative sleep (Nishikawa et al., 2021).

Insomnia is often influenced by mood disorders such as depression, which can further amplify its negative effects on well-being. Both depression and insomnia are common mental health challenges among students, significantly impairing their academic performance, social interactions, and overall quality of life (Dong & Yang, 2019). Depression, characterized by persistent feelings of sadness, hopelessness, and a lack of interest in daily activities, is often closely intertwined with sleep disturbances (Claßen, Friedrich, & Schlarb, 2022). The relationship between depression and insomnia is complex and bidirectional, with each condition influencing and potentially worsening the other (Williams et al., 2020). Students experiencing depression often struggle with racing thoughts, rumination, and heightened emotional distress at night, making it difficult to relax and fall asleep (Akram et al., 2019). Conversely, chronic insomnia can lead to mood disturbances, increased irritability, and a diminished ability to cope with stress, all of which can contribute to the onset or worsening of depressive symptoms (Rangel, Raposo, & Rocha-Filho, 2021). This cyclical relationship creates a self-reinforcing loop that is difficult to break, further entrenching students in patterns of poor sleep and declining mental health (Regli et al., 2024).

As the prevalence of insomnia symptoms continues to rise among this demographic, there is an increasing need for effective, non-pharmacological interventions that can help students manage their sleep problems (Zhang et al., 2015). Mindfulness-Based Stress Reduction (MBSR), a therapeutic approach that combines mindfulness meditation, body awareness, and yoga, has attracted attention as a promising strategy to alleviate insomnia symptoms (Chen et al., 2020). By promoting present-moment awareness and reducing stress, MBSR aims to break the cycle of worry, anxiety, and negative thinking that often underpins insomnia (Zhang, Li, Li, & Chen, 2019). MBSR teaches students to become more aware of their thoughts and feelings without judgment, allowing them to disengage from the mental patterns that contribute to insomnia (Kim et

al., 2022). Techniques such as mindful breathing, body scans, and gentle movement are designed to cultivate a sense of calm and relaxation, which can directly improve sleep quality (Wang et al., 2020). By addressing the cognitive and emotional components of insomnia, MBSR helps reduce hyperarousal, a key factor that disrupts sleep (Liu et al., 2022). Research has shown that students who engage in mindfulness practices report decreased sleep latency, fewer nighttime awakenings, and improved overall sleep satisfaction (Suh et al., 2021). The relationship between MBSR and insomnia symptoms is grounded in the program's ability to lower physiological stress responses and enhance emotional regulation (Rash, Kavanagh, & Garland, 2019). For students, this means not only improved sleep but also better management of academic stress, reduced anxiety, and enhanced focus and resilience (Perini et al., 2023). As students learn to respond to stressors with greater equanimity, they can break the habitual cycles of rumination and worry that often prevent restful sleep (Şener Çetin, Nacar, & Timur Taşhan, 2024).

The increasing prevalence of insomnia among students, exacerbated by academic pressures, irregular schedules, and excessive screen time, has profound effects on their overall health, cognitive function, and academic performance. Insomnia disrupts sleep and is linked to elevated levels of worry, cognitive distortions, and depression, creating a harmful cycle that impairs students' well-being. Addressing these issues is crucial, as poor sleep and associated mental health problems compromise concentration, memory, and emotional stability. Non-pharmacological interventions, such as MBSR, offer a promising approach by fostering relaxation, reducing stress, and improving sleep quality. Integrating MBSR into student wellness programs is vital for enhancing sleep and managing stress. This study aims to evaluate the effectiveness of MBSR in reducing worry, cognitive distortions, and depression in students with insomnia symptoms.

Method

Participants

The current study employed a quasi-experimental design with a pre-test, post-test, and control group. The research population consisted of university students in Ardabil Province during the 2023-2024 academic year. A sample of 34 participants was purposefully selected based on Insomnia Severity Index scores greater than 15 (Bastien, Vallières, & Morin, 2001). The participants were randomly assigned (through a lottery) to either the intervention group (17 participants) or the control group (17 participants). The required sample size for quasi-experimental studies, considering a 2.5 effect size (d), 90% power, a significance level of 0.05, and a standard deviation (σ) of 7.63, was calculated to be 30. To account for potential dropouts, the sample size was set to 17 participants per group (Esrafilian et al., 2024).

$$n = \left(\frac{\sigma(z_{1-\alpha/2} + z_{1-\beta})}{d} \right)^2$$

Inclusion criteria for the study were obtaining a cutoff score on the Insomnia Severity Index, full consent to participate, and non-participation in other psychological sessions. Exclusion criteria included an incomplete questionnaire and missing more than two treatment sessions. Ethical considerations were strictly observed in this study. Participants were assured of the confidentiality and that their data solely for research purposes. They completed the questionnaires in a calm, stress-free environment with full consent.

Ethical Statement

This study was conducted in strict accordance with the ethical guidelines set forth by the Committee on Publication Ethics (COPE) and the Helsinki Declaration. All necessary ethical considerations were upheld, including obtaining informed consent, ensuring participant confidentiality, and maintaining transparency in research practices. The study adhered to the principles of integrity, honesty, and responsible research conduct as outlined by COPE while also complying with the Helsinki Declaration's guidelines for ethical medical research involving human subjects.

Procedure

After randomly assigning the sample members to the experimental and control groups, the experimental group received the MBSR training program by Chaskalson (2011) over eight 90-minute sessions, with one session held each week. Meanwhile, the control group was placed on a waiting list (see Table 1). After the intervention, both groups underwent a post-test. Statistical data were analyzed using SPSS software 27 for descriptive and inferential levels. Descriptive data were presented using tables and statistics, such as mean and standard deviation. Multivariate analysis of covariance (MANCOVA) was used for inferential data analysis. Table 1 summarizes the mindfulness sessions received by the experimental group.

Measures

Insomnia Severity Index (ISI): Developed by Bastien et al. (2001), it is a self-report questionnaire designed to assess an individual's perception of insomnia severity. It consists of seven items evaluating various aspects of sleep difficulties, including sleep onset, sleep maintenance, early morning awakening, satisfaction with sleep patterns, daytime functional impairment, perceived significance of the sleep problem by others, and the distress caused by insomnia. Each item is rated on a 5-point Likert scale ranging from 0 (never) to 4 (very much), with total scores categorized as follows: no significant insomnia (0–7), subthreshold insomnia (8–14), moderate clinical insomnia (15–21), and severe insomnia (22–28). The ISI psychometric properties reported by Bastien et al. (2001) include an internal consistency reliability of 0.74, concurrent validity with a sleep diary of 0.65, and item-total correlations ranging from 0.37 to 0.69. Additionally, Cronbach's alpha coefficient for this study was reported as 0.81.

Penn State Worry Questionnaire (PSWQ): It is a 16-item scale developed by Meyer et al. (1990) to measure the severity and uncontrollability of worry. The response scale is a 5-point Likert scale, with each item scored from 1 ("not at all typical") to 5 ("very typical"), resulting in a total score ranging from 16 to 80, where higher scores indicate greater levels of worry. This questionnaire has high internal consistency, with Cronbach's alpha coefficients ranging from 0.86 to 0.96, and test-retest reliability reported over four weeks ranging from 0.74 to 0.93. In the present study, the Cronbach's alpha coefficient for this questionnaire was 0.86.

Cognitive Distortions Questionnaire (CDQ): Designed by Hamamci and Ozturk (2004), this questionnaire, with 19 items, is scored on a five-point Likert scale, comprising three subscales: Rejection in Interpersonal Relationships (9 items), Unrealistic Expectations in Relationships (10 items), and Misperception in Interpersonal Relationships (11 items). Scoring is based on the Likert scale, with responses ranging from 1 to 5 points. The total score ranges from 19 to 95, where scores closer to 95 indicate higher levels of cognitive distortions, and scores closer to 19 indicate lower levels of cognitive distortions. In the study by

Hamamci & Ozturk (2004), the reliability of this questionnaire was assessed through internal consistency using Cronbach's alpha and test-retest after two weeks, resulting in coefficients of 0.67 and 0.74 for the overall scale, 0.73 and 0.70 for the Rejection in Interpersonal Relationships subscale, 0.66 and 0.76 for the Unrealistic Expectations in Relationships subscale, and 0.43 and 0.74 for the Misperception in Interpersonal Relationships subscale (Hamamci & Ozturk, 2004). The validity of the questionnaire was established through correlations with the Irrational Beliefs Scale (0.53), the Automatic Thoughts Scale (0.45), and the Interpersonal Conflict Tendency Scale (0.53), all of which were significant (Hamamci & Ozturk, 2004). In the present study, Cronbach's alpha coefficients for the subscales of the CDQ ranged from 0.82 to 0.89, indicating strong internal consistency.

Beck Depression Inventory (BDI): Developed by Beck et al. (1996), it is a widely used self-report questionnaire designed to assess the severity of depression symptoms in individuals aged 13 and older. It consists of 21 multiple-choice items, each corresponding to a specific symptom of depression. Each item is scored on a scale from 0 to 3, with total scores ranging from 0 to 63. Higher scores indicate greater severity of depressive symptoms, with commonly used cutoffs as follows: minimal depression (0–13), mild depression (14–19), moderate depression (20–28), and severe depression (29–63). Beck et al. (1996) reported the validity of the test as 96.0, with internal consistency ranging from 73.0 to 92.0 and a mean of 86.0. The Cronbach's alpha coefficient for patients and non-patients was reported as 0.86 and 0.81, respectively. In the current study, the Cronbach's alpha coefficient for this scale was also calculated and found to be 0.91.

Table 1. Summary of Mindfulness Sessions for the Experimental Group (Chaskalson, 2011)

Session	Target
1	Overview of the MBSR, components, goals, and expectations of the intervention. Introduction to mindful attention, providing feedback, and discussing the completed practices. Explanation of the automatic guidance system and how to apply present-moment awareness of bodily sensations. Assignment of homework.
2	Review of assignments, body scan practice, mindful breathing meditation, feedback on breathing meditation, visual explanation and practice of yoga stretching exercises, instruction on recording pleasant experiences, and setting homework for the next week.
3	Review of assignments, mindful sitting session with awareness of breathing (sitting meditation), discussion and feedback on sitting meditation, group yoga practice in groups of five, three-minute breathing exercise, instruction on recording unpleasant experiences, and setting homework to record unpleasant experiences
4	Review of assignments, repetition of the body scan practice, five-minute seeing or hearing exercise, repeat of the mindful sitting session with awareness of breathing and body, and assignment of homework.
5	Review of assignments, breathing exercises, mindful sitting session (awareness of breathing, body, sounds, and thoughts), explanations about tension and identifying participants' reactions to it, examination of awareness of pleasant and unpleasant events on feelings, thoughts, and bodily sensations, mindful yoga practice, three-minute breathing exercise, and setting homework for the next week.
6	Review of assignments, body scan practice, mindful yoga, sitting meditation (awareness of sounds and thoughts), and setting homework for the next week.

7	Review of assignments, repetition of previous session practices, creation of a list of enjoyable activities, mountain meditation training, and setting homework for the next week.
8	Review of assignments, body scan practice, a comprehensive review of the entire program and the skills taught, considering participants' initial goals in a group setting, discussion of the plans and exercises, concluding the class with the final meditation, and emphasizing the importance of daily and consistent practice of the exercises taught during the 8 sessions.

Results

The mean and standard deviation of the age of the intervention group were 25.12±5.06 and 25.81±4.33, respectively. The chi-square test results showed that the intervention and control groups had no significant differences in age, gender, marital status, educational level, and sleep duration (P>0.005). The mean and SD of pre-test and post-test scores of worry, cognitive distortions, and depression in students with insomnia symptoms in the experimental and control groups are presented in Table 2. The Shapiro-Wilk test (S-W) findings are also included in this table to examine the normality of the variable distributions in the two groups. This table shows that not all variables are significant using the Shapiro-Wilk statistics. As a result, the variable distribution is considered normal.

Table 2. Descriptive Indices of Study's Variables in Control and Experimental Groups

Variables		Groups	Mean	SD	S-W	P*
Insomnia Symptoms	Pre-test	Experimental	18.65	2.69	0.106	0.057
		Control	18.44	2.50	0.114	0.068
	Post-test	Experimental	15.37	2.39	0.098	0.080
		Control	18.09	2.81	0.087	0.073
Worry	Pre-test	Experimental	47.41	1.63	0.113	0.069
		Control	47.35	1.08	0.140	0.081
	Post-test	Experimental	44.17	1.63	0.093	0.074
		Control	47.71	1.77	0.085	0.052
Rejection in Interpersonal Relationships	Pre-test	Experimental	22.52	1.21	0.141	0.094
		Control	22.64	1.38	0.120	0.099
	Post-test	Experimental	19.52	1.96	0.097	0.051
		Control	22.41	1.37	0.098	0.075
Unrealistic Expectations in Relationships	Pre-test	Experimental	24.71	1.48	0.084	0.069
		Control	24.58	1.68	0.090	0.057
	Post-test	Experimental	21.88	1.50	0.103	0.064
		Control	24.82	1.93	0.108	0.083
Misperception in Interpersonal Relationships	Pre-test	Experimental	21.35	1.63	0.122	0.085
		Control	21.47	1.59	0.109	0.061
	Post-test	Experimental	18.41	1.47	0.142	0.087
		Control	21.23	1.62	0.100	0.063
Depression	Pre-test	Experimental	25.53	1.84	0.106	0.054
		Control	25.64	1.60	0.104	0.090
	Post-test	Experimental	22.05	1.32	0.095	0.052
		Control	25.41	2.41	0.014	0.079

* *Shapiro-Wilk test*

Multivariate analysis of covariance was used to evaluate the efficacy of MBSR in worry, cognitive distortions, and depression in students with insomnia symptoms. The results of the Levin test to examine the homogeneity of variance of dependent variables in groups showed that the variance of worry (F=1.92, P=>0.260), cognitive distortions (F=1.84, P=>0.235), and depression (F=1.54, P=>0.204) were equal in the groups. The results of the box test to evaluate the equality of the covariance matrix of dependent variables between the experimental and control groups showed that the covariance matrix of the dependent variables is equal (Box M = 17.01, F=0.94, P=>0.518). The significance of the box test is greater than 0.05, so this assumption is valid. Additionally, the findings of the Chi-Square-Bartlett test used to determine the sphericity or importance of the link between worry, cognitive distortions, and depression revealed that there is a substantial association between them (χ^2=134.16, df=14, P<0.05). Another important assumption of multivariate analysis of covariance is the homogeneity of regression coefficients. The homogeneity test of regression coefficients was examined via the interaction of dependent variables and independent variables (intervention method) in the pre-test and post-test. The interaction of these pre-tests and post-tests with the independent variable was not significant and indicated the homogeneity of regression slope; Therefore, this assumption also holds (F=0.901, P=0.342). Considering the establishment of multivariate analysis of covariance, using this test will be allowed. Then, to find out the differences between the groups, a multivariate analysis of covariance was performed (See Table 3).

Table 3 . The Results of Multivariate Analysis of Covariance on Mean Post-Test Scores

Test	Value	F	df	Error df	P	Effect Value
Pillai's Trace	0.689	10.188	5	23	<0.001	0.68
Wilks Lambda	0.311	10.188	5	23	<0.001	0.68
Hotelling Trace	2.215	10.188	5	23	<0.001	0.68
Roy's Largest Root	2.215	10.188	5	23	<0.001	0.68

According to Table 3, the results showed the effect of the independent variable on the dependent variables; in other words, experimental and control groups have a significant difference in at least one of the variables of worry, cognitive distortions, and depression, which according to the calculated effect size, 68% of the total variance of experimental and control groups is due to the effect of the independent variable. Thus, the test's statistical power is 1, which indicates the adequacy of the sample size. However, to determine in which areas the difference is significant, a univariate analysis of the covariance test was used in the MANCOVA test, the results of which are reported in Table 4.

Table 4 . Results of Univariate Analysis of Covariance on the Mean of Post-Test Scores of Dependent Variables in Experimental and Control Groups

Variables	SS	SS Error	DF	MS	MS Error	F	P	Effect Value
Worry	107.011	61.65	1	107.011	2.28	46.86	0.001	0.63
Rejection in Interpersonal Relationships	63.430	56.94	1	63.430	2.10	30.07	0.001	0.52
Unrealistic Expectations in Relationships	75.575	49.12	1	75.575	1.81	41.54	0.001	0.61
Misperception in Interpersonal Relationships	60.255	53.54	1	60.255	1.98	30.38	0.001	0.53
Depression	89.644	58.76	1	89.644	2.17	41.20	0.001	0.60

Based on the contents of Table 4, the F-statistic is significant for worry (F=46.86), rejection in interpersonal relationships (F=30.07), unrealistic expectations in relationships (F=41.54), misperception in interpersonal

relationships (F=30.38), and depression (F=41.20) at 0.001. These findings indicate a significant difference between the groups in these variables. Furthermore, based on the calculated effect size, 63% of worry, 52% of rejection in interpersonal relationships, 61% of unrealistic expectations in relationships, 53% of misperception in interpersonal relationships, and 60% of depression was independent of the effect of the variable; consequently, it can be stated that MBSR significantly decreases worry, cognitive distortions, and depression among students with insomnia symptoms.

Discussion and Conclusion

The present study was conducted to determine the effectiveness of MBSR in reducing worry, cognitive distortions, and depression in students with insomnia symptoms. The findings of the present study indicate that students with insomnia symptoms reported a significant reduction in worry after undergoing MBSR. This finding is consistent with previous research highlighting the effectiveness of mindfulness interventions in managing stress and anxiety, which are known contributors to sleep disturbances (Menghini et al., 2023). MBSR, through its combination of mindfulness meditation, body awareness, and gentle yoga, appears to have a beneficial impact on students' ability to manage intrusive thoughts and stress, thereby improving sleep quality (Zhang et al., 2019). The findings are consistent with previous research, confirming the bidirectional relationship between worry and insomnia. Studies have shown that persistent worry contributes to sleep disturbances, while inadequate sleep intensifies anxious thoughts (Wallsten et al., 2023; Scotta, Cortez, & Miranda, 2022; Menghini et al., 2023).

One key mechanism by which MBSR may reduce worry is through its emphasis on present-moment awareness (Şener Çetin et al., 2024). By training students to observe their thoughts and feelings non-judgmentally, MBSR helps them distance themselves from patterns of rumination that often exacerbate insomnia (Rash et al., 2019). This shift in cognitive approach can diminish the intensity and frequency of worry, leading to improved relaxation and more restful sleep (Liu et al., 2022). The reduction in worry also likely contributes to decreased physiological arousal, which is crucial for initiating and maintaining sleep (Wang et al., 2020). Moreover, the decrease in worry reported by students may reflect broader improvements in emotional regulation and stress management (Lindsay et al., 2022). By cultivating mindfulness, students can better cope with academic pressures and personal stressors, leading to a more balanced emotional state that supports healthy sleep patterns (Ballesio et al., 2021). This aligns with findings from other studies that have documented the efficacy of mindfulness techniques in reducing stress and enhancing overall well-being (Chen et al., 2020).

The results of the present study show that students with insomnia symptoms experienced a significant decrease in cognitive distortions after participating in MBSR. These findings align with existing literature that highlights the benefits of mindfulness practices in reducing cognitive distortions and improving mental health outcomes. The reduction in cognitive distortions not only suggests potential improvements in sleep but also indicates a broader positive impact on students' emotional well-being and stress management (Chaskalson, 2011). These results are consistent with previous studies emphasizing the effectiveness of mindfulness-based interventions in reducing cognitive distortions and enhancing psychological health (Jansson-Fröjmark et al., 2024; Tang et al., 2023; Nishikawa et al., 2021).

This finding underscores the effectiveness of MBSR in addressing not only sleep disturbances but also the maladaptive thought patterns that often accompany insomnia (Perini et al., 2023). Cognitive distortions, such as catastrophizing, overgeneralizing, and black-and-white thinking, can exacerbate insomnia by heightening

stress and anxiety, making it difficult for individuals to relax and fall asleep (Jansson-Fröjmark et al., 2024). MBSR's emphasis on mindfulness and cognitive awareness is particularly relevant in mitigating these cognitive distortions (Şener Çetin et al., 2024). By fostering an increased awareness of one's thoughts and promoting a non-judgmental approach to these thoughts (Sheykhangafshe et al., 2022), MBSR helps students recognize and challenge irrational and negative thinking patterns (Perini et al., 2023). This process encourages a more balanced perspective, reducing the frequency and intensity of cognitive distortions (Badawy, 2024). As students learn to observe their thoughts without becoming entangled in them, they are better equipped to manage the mental arousal that disrupts sleep (Suh et al., 2021). In addition, the reduction in cognitive distortions observed in this study suggests that MBSR may contribute to an improved overall cognitive and emotional state (Liu et al., 2022). By addressing distorted thinking, MBSR helps break the cycle of negative thought patterns that can contribute to insomnia (Tang et al., 2023). This improvement in cognitive processing can lead to better sleep quality, as students are less likely to experience mental hyperarousal that typically interferes with restful sleep (Rash et al., 2019).

The results of the present study indicate that students with insomnia symptoms experienced a significant reduction in depression following MBSR. This finding underscores the potential of MBSR as an effective intervention for addressing both sleep disturbances and depressive symptoms in students. Depression, which often coexists with insomnia, can exacerbate sleep problems and significantly impact overall well-being. By reducing depressive symptoms, MBSR not only improves emotional health but also potentially contributes to better sleep quality (Kim et al., 2022). These results are consistent with previous studies highlighting the effectiveness of mindfulness-based interventions in alleviating depressive symptoms and improving sleep quality (Dong & Yang, 2019; Regli et al., 2024; Williams et al., 2020).

MBSR's impact on depression can be attributed to its core principles of mindfulness and stress reduction (Zhang et al., 2015). Through mindfulness meditation and other practices, MBSR helps students develop greater awareness of their thoughts and emotions, fostering a non-judgmental approach to these experiences (Chaskalson, 2011). This enhanced awareness can facilitate the identification and management of negative thought patterns that contribute to depressive symptoms (Regli et al., 2024). Additionally, by promoting relaxation and reducing stress, MBSR can alleviate some of the psychological burden that exacerbates depression (Claßen et al., 2022). The reduction in depression reported by students suggests that MBSR may improve their emotional regulation and coping mechanisms (Williams et al., 2020). This is particularly relevant for students, who often face significant academic and social pressures that can lead to increased depressive symptoms (Perini et al., 2023). MBSR's emphasis on present-moment awareness and self-compassion helps students manage stress more effectively, which in turn can reduce feelings of hopelessness and sadness associated with depression (Wang et al., 2020).

The present study provides compelling evidence that MBSR is an effective intervention for reducing worry, cognitive distortions, and depression among students with insomnia. The significant decreases in these areas observed following MBSR therapy highlight its potential to address the mental and emotional factors that contribute to sleep disturbances. By promoting present-moment awareness, enhancing cognitive flexibility, and fostering emotional regulation, MBSR offers a valuable approach to improving sleep quality and overall mental health in students. These findings underscore the importance of incorporating mindfulness-based practices into student wellness programs. Given the high prevalence of insomnia, stress, and cognitive

distortions among students, MBSR provides a practical, non-pharmacological solution to enhance sleep and mental well-being. Integrating MBSR into student support programs can help address both sleep disturbances and the negative thought patterns that exacerbate them, thereby supporting students in managing academic and personal stressors more effectively.

Limitations and Suggestions

The study's small sample size of 34 students and use of purposeful sampling may limit the generalizability and introduce selection bias. The short duration of the MBSR intervention and reliance on self-report measures restrict the ability to assess long-term effects and may introduce response biases. Additionally, the lack of follow-up data prevents evaluation of the sustainability of MBSR's impact. Future research should involve larger and more diverse samples to enhance generalizability. Long-term studies with extended follow-ups are needed to assess the durability of MBSR effects. Incorporating objective measures alongside self-reports could provide a more comprehensive assessment. Investigating the underlying mechanisms of MBSR and comparing its effectiveness with other treatments would further clarify its benefits.

Conflicts of Interests

The authors declare that they have no conflicts of interest related to this study.

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