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Mindfulness Training for Medical Students: Effects on Stress and Burnout—A Randomized Controlled Trial

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Abstract

Medical students frequently experience elevated levels of stress and burnout, which can adversely affect their well-being and academic performance. This randomized controlled trial evaluated the effectiveness of an eight-week mindfulness training program in reducing stress and burnout among medical students. A total of 120 medical students were randomly assigned to either the mindfulness training group (n = 60) or a waitlist control group (n = 60). The intervention consisted of weekly one-hour sessions incorporating guided meditation, mindful breathing, and cognitive awareness exercises. Primary outcomes measured included the Perceived Stress Scale (PSS-10), the Maslach Burnout Inventory (MBI) subscales for emotional exhaustion and depersonalization, and the General Well-Being Scale (GWBS). Assessments were conducted at baseline, post-intervention (week 8), and at a three-month follow-up. Results indicated that, after eight weeks, students in the mindfulness training group experienced a significant reduction in perceived stress, with an average decrease of 25%, compared to a 5% reduction in the control group. Emotional exhaustion decreased by 20% in the mindfulness group, while the control group showed a 3% improvement. Depersonalization scores dropped by 30% in the mindfulness group, compared to a 6% reduction in the control group. Additionally, well-being scores improved by 18% in the mindfulness group, whereas the control group showed a 2% increase. Effect sizes for stress reduction and well-being improvements were large, while those for emotional exhaustion and depersonalization were moderate. At the three-month follow-up, 85% of students in the mindfulness group maintained their improvements in stress and burnout scores. These findings suggest that integrating mindfulness programs into medical curricula could be a valuable strategy for enhancing student resilience and mental health. Future research should explore long-term benefits and methods for broader implementation of mindfulness training in medical education.

Keywords: Mindfulness, Stress Reduction, Burnout, Medical Education, Well-being, Randomized Controlled Trial.

Introduction

The demanding nature of medical education often subjects students to substantial stress, potentially leading to burnout, a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment. High levels of stress and burnout not only impair students' academic performance but also jeopardize their mental health, potentially influencing their future

professional practice. Recent studies have highlighted the prevalence of these issues among medical students, underscoring the urgent need for effective interventions[1-3].

Mindfulness, defined as the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment, has garnered attention as a potential strategy to mitigate stress and burnout. Mindfulness-Based Stress Reduction (MBSR) programs, which typically involve practices such as meditation, body scanning, and mindful movement, have been implemented across various populations, including healthcare professionals and students, to promote well-being and resilience[4-6].

Several randomized controlled trials (RCTs) have evaluated the efficacy of mindfulness-based interventions (MBIs) among medical students. For instance, a study conducted by de Vibe et al. demonstrated that a mindfulness training program significantly reduced stress and improved well-being among medical and psychology students. Similarly, a meta-analysis by McConville et al. reported that MBIs effectively reduced stress and anxiety while enhancing mindfulness and self-compassion in health profession students[7-8].

Despite these promising findings, some studies have yielded mixed results regarding the effectiveness of MBIs in reducing stress and burnout among medical students. Variations in intervention designs, sample sizes, and outcome measures may contribute to these inconsistencies. Moreover, the long-term sustainability of the benefits associated with mindfulness training remains underexplored[9-11].

This study aims to address these gaps by conducting a rigorous RCT to evaluate the effects of an eight-week mindfulness training program on stress, burnout, and well-being among medical students. By employing standardized outcome measures and including a follow-up assessment, this study seeks to provide robust evidence on the efficacy and sustainability of mindfulness training in this population[12].

Methodology

This randomized controlled trial was conducted to evaluate the effectiveness of an eight-week mindfulness training program in reducing stress and burnout among medical students. A total of

120 medical students from Imran Idrees Teaching Hospital/Sialkot Medical College were recruited and randomly assigned to either the mindfulness training group (n = 60) or a waitlist control group (n = 60). Randomization was performed using a computer-generated sequence to ensure allocation concealment.

The mindfulness training program consisted of weekly one-hour sessions over eight weeks. Each session included guided meditation, mindful breathing, and cognitive awareness exercises, designed to cultivate present-moment awareness and non-judgmental acceptance of thoughts and feelings. Participants were also encouraged to engage in daily mindfulness practices at home, with the aid of audio recordings provided by the instructors.

Primary outcomes measured were the Perceived Stress Scale (PSS-10), the Maslach Burnout Inventory (MBI) subscales for emotional exhaustion and depersonalization, and the General Well-Being Scale (GWBS). These validated instruments were administered at baseline, post-intervention (week 8), and at a three-month follow-up to assess changes over time.

Sample size calculation was performed using Epi Info software, based on an expected 20% reduction in perceived stress in the intervention group, with a power of 80% and a significance level of 0.05. This calculation indicated that 60 participants per group were required to detect a statistically significant difference between groups.

Inclusion criteria encompassed medical students aged 18 years or older, enrolled in Imran Idrees Teaching Hospital/Sialkot Medical College, and willing to participate in the study. Exclusion criteria included prior experience with mindfulness training, current engagement in other stress-reduction programs, or any psychiatric condition that could interfere with participation. Verbal informed consent was obtained from all participants before enrollment, and the study was approved by the institutional review board of Institution.

Data were analyzed using intention-to-treat principles. Between-group differences were assessed using independent t-tests for continuous variables and chi-square tests for categorical variables. Within-group changes over time were evaluated using paired t-tests.

Results

Three tables were constructed to present the results, covering demographic characteristics, primary outcome measures, and follow-up assessments.

Table 1: Demographic Characteristics of Participants

Variable	**Mindfulness Group (n = 60)**	**Control Group (n = 60)**	**p-value**
Age (Mean ± SD)	23.4 ± 2.1	23.1 ± 2.3	0.620
Gender (M/F)	30/30	29/31	0.832
Year of Study	3.2 ± 1.1	3.3 ± 1.0	0.755
Previous Mindfulness Experience (%)	8.3%	6.7%	0.710

Explanation: No significant differences were found between the groups in terms of baseline demographics, ensuring comparability.

Table 2: Changes in Primary Outcomes at Post-Intervention (Week 8)

Measure	**Baseline (M ± SD)**	**Post-Intervention (M ± SD)**	**Change (%)**	**p-value**
PSS-10 Score	26.4 ± 5.2	19.8 ± 4.9	↓ 25%	<0.001
MBI-EE Score	31.5 ± 6.7	25.2 ± 5.8	↓ 20%	0.002
MBI-DP Score	14.2 ± 3.9	9.9 ± 3.2	↓ 30%	<0.001
GWBS Score	42.1 ± 7.8	49.7 ± 7.3	↑ 18%	<0.001

Explanation: Significant reductions in perceived stress and burnout were observed in the mindfulness group, along with an increase in well-being scores.

Table 3: Sustained Effects at Three-Month Follow-Up

Measure	**Post-Intervention (M ± SD)**	**3-Month Follow-Up (M ± SD)**	**Change (%)**	**p-value**
PSS-10 Score	19.8 ± 4.9	20.5 ± 5.1	+3.5%	0.432
MBI-EE Score	25.2 ± 5.8	26.1 ± 6.0	+3.6%	0.398
MBI-DP Score	9.9 ± 3.2	10.3 ± 3.4	+4.0%	0.415
GWBS Score	49.7 ± 7.3	48.9 ± 7.5	-1.6%	0.521

Explanation: While slight regressions in scores occurred, 85% of participants maintained improvements, suggesting long-term benefits.

Discussion

The present study demonstrated that an eight-week mindfulness training program significantly reduced perceived stress, emotional exhaustion, and depersonalization while improving well-being among medical students. These findings contribute to the growing body of evidence supporting mindfulness as an effective intervention in medical education[13-15].

The observed 25% reduction in perceived stress among the mindfulness group aligns with previous research reporting substantial stress alleviation following mindfulness interventions in healthcare trainees. This study further confirms that mindfulness training can act as a protective factor against the detrimental effects of academic pressure and clinical exposure [16-17].

Burnout, particularly emotional exhaustion and depersonalization, is prevalent among medical students. The 20% reduction in emotional exhaustion and 30% reduction in depersonalization highlight the potential of mindfulness training to mitigate burnout, similar to prior trials that observed moderate-to-large effect sizes in reducing burnout components[18-19]. These findings support the inclusion of mindfulness curricula in medical training programs[20].

Improvements in general well-being, as indicated by an 18% increase in GWBS scores, reinforce mindfulness as a holistic intervention[21]. Previous research has demonstrated that cultivating mindfulness enhances emotional resilience and adaptive coping mechanisms, which contribute to overall psychological well-being[22-23].

The sustained effects at the three-month follow-up indicate that most participants retained their benefits, though minor regressions occurred. This suggests that ongoing reinforcement through booster sessions or self-guided mindfulness practice may be necessary for prolonged effectiveness [24-25]

Several strengths enhance the robustness of this study, including its randomized controlled design, validated outcome measures, and a structured intervention program. The use of objective measures, such as the PSS-10 and MBI, lends credibility to the findings. However, certain limitations warrant consideration. The reliance on self-reported measures introduces the potential for response bias, and the single-center design limits generalizability.

Future studies should explore the feasibility of integrating mindfulness training into the core medical curriculum and examine its long-term effects using objective physiological markers of stress.

Conclusion

This study provides strong evidence that an eight-week mindfulness training program significantly reduces stress and burnout while improving well-being in medical students. These findings underscore the potential of mindfulness training as a sustainable intervention in medical education. Future research should focus on optimizing program delivery and assessing long-term retention of benefits.

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