



Overcoming Loneliness through Mindfulness Intervention in Nursing Students: A Quasi-Experimental Study

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ABSTRACT

Background: Loneliness is a significant issue among nursing students, often leading to mental health challenges. Mindfulness interventions have been shown to reduce loneliness by promoting emotional regulation. However, despite its importance, research on the impact of short-term mindfulness programs specifically for nursing students remains limited. **Purpose:** This study aims to investigate the effect of a two-week mindfulness intervention on reducing loneliness among nursing students. **Methods:** A quasi-experimental, one-group pretest-posttest design was employed, using convenience sampling to select 85 nursing students who were available and willing to participate in the study. The UCLA Loneliness Scale was used to measure loneliness before and after the intervention. Data analysis was performed using SPSS, version 26, where paired t-tests were conducted to assess the differences in loneliness scores before and after the intervention. **Results:** The results indicated a significant reduction in loneliness scores post-intervention ($p < 0.001$). The effect size was moderate (Cohen's $d = 0.49$), suggesting the intervention's effectiveness in reducing loneliness. **Conclusion:** This study demonstrates that a two-week mindfulness intervention can significantly reduce loneliness in nursing students. Future research should explore the long-term effects of such interventions and include a control group to strengthen the findings. **Implications for Nursing:** This intervention offers a potential solution for addressing loneliness in nursing students, improving their mental health, and enhancing their academic performance. Nursing educators should consider integrating mindfulness practices into curricula to support students' emotional well-being, such as by incorporating brief mindfulness sessions or mindfulness-based stress reduction techniques.

Keywords: Loneliness, Mindfulness, Nursing students.

What does this paper add?

1. This study provides evidence on the effectiveness of a brief mindfulness intervention in reducing loneliness among nursing students.
2. The research highlights the potential of mindfulness

practices to enhance emotional regulation and social functioning in a high-stress academic environment.

3. This paper explores the relevance of mindfulness as a mental health strategy tailored to the unique needs of nursing students.

4. It contributes to the growing body of research on mindfulness-based interventions in student populations, specifically in an Indonesian context.
5. The findings suggest that even short-term interventions can yield meaningful improvements in students' emotional well-being and mental health outcomes.

Introduction

Mental health in university students is closely associated with learning engagement and academic performance. Therefore, further research is needed to address mental health symptoms that can interfere with learning, such as stress, depressive symptoms, and loneliness (Chiodelli et al., 2022). Students in higher education often face demanding academic tasks that increase cognitive load and require sustained attention, problem solving, and decision making (Gabriely et al., 2020). When cognitive demands exceed an individual's adaptive capacity, psychological strain may increase and weaken learning effectiveness, which supports the need for evidence based interventions that promote students' well-being and academic functioning (Yang et al., 2020).

The Transactional Model of Stress and Coping developed by Lazarus and Folkman (1984) explains stress as a result of an individual's assessment of a particular situation, which may be perceived as either a threat or a challenge (Lazarus & Folkman, 1984). This process involves two types of appraisal: primary appraisal, which determines whether the situation poses a threat or harm to an individual's well-being, and secondary appraisal, which assesses whether the individual has enough resources to cope with it (Abu Shosha & Al-Kalaldeh, 2020). Loneliness can be viewed as a situation that leads to primary appraisal as a threat to an individual's emotional well-being, especially if the person feels socially or emotionally isolated. When loneliness is perceived as a threat, the individuals will undergo secondary appraisal, where they assess whether they have effective coping strategies to manage those feelings (Zimmer-Gembeck, 2016). If individuals feel that they lack the strategies or resources to cope with loneliness, this can exacerbate their emotional state (Daly et al., 2022).

Loneliness is a subjective and distressing experience that arises when individuals perceive a discrepancy between desired and actual social connection, and it is

increasingly recognized as a relevant concern in university settings. Evidence from longitudinal research suggests that loneliness is associated with subsequent depressive symptoms, indicating that loneliness may function as an important vulnerability factor for emotional distress (Allen et al., 2022; Hafez et al., 2024; Yosep et al., 2023). Emotion regulation difficulties, distress, and depressive symptoms can also be reciprocally related over time, reinforcing the rationale for interventions that strengthen emotional awareness and regulation processes (Alzayyat et al., 2024; Dwidiyanti et al., 2021). Taken together, this literature indicates that loneliness is not only a social issue, but also a mental health related experience that may compromise students' adaptation and learning.

In the Indonesian context, spiritual and religious coping is frequently described as a meaningful approach to managing psychological distress among students. Prior studies have reported that students use varied coping strategies when facing depressive experiences, including behavioral withdrawal, engaging in daily activities, and religious practices, such as praying and worshiping, as well as help seeking through family discussions (Hardiyati et al., 2025; Hikmat et al., 2025). Spiritual-based approaches may offer culturally acceptable pathways to strengthen adaptive coping and emotional stability in students (Dwidiyanti et al., 2021). In our preliminary screening, loneliness was common among nursing students, with 29.8 percent reporting severe loneliness and 70.2 percent reporting moderate loneliness, indicating a need for targeted support on campus.

Loneliness has been conceptualized as a multifaceted experience that includes both emotional isolation, such as feeling misunderstood or lacking closeness, and social isolation, such as limited social integration or companionship (El-Monshed et al., 2022). In university settings, loneliness may persist even when individuals are surrounded by peers, because it is influenced not only by the number of social contacts, but also by the perceived quality and meaning of those relationships (Turan et al., 2020). Mindfulness may be relevant to loneliness, because it encourages present moment awareness and a non-judgmental stance toward thoughts and emotions, which can reduce reactivity to loneliness related distress (Raymond & Sheppard, 2017). By fostering acceptance and attentional regulation, mindfulness practice may help individuals

relate differently to feelings of disconnection and may support more adaptive coping responses when loneliness arises.

Mindfulness oriented interventions may be relevant, because they train attention, present moment awareness, and a non-judgmental stance toward internal experiences, which can help students respond more adaptively to loneliness related thoughts and emotions (Zhang et al., 2021). Prior controlled evidence has shown that mindfulness training can reduce loneliness and may improve social functioning, although effects can vary by population and intervention characteristics (Godara et al., 2021b). Mindfulness consists of several key factors which include full awareness of the present moment, observation without judgment, and acceptance of internal experiences without trying to change them (Tudor et al., 2022). In Indonesia, mindfulness programs that integrate spiritual meaning making have also been developed and reported to support students' emotional adaptation and depressive symptom reduction, suggesting potential contextual relevance for nursing education settings (Yulina et al., 2020).

This research adds novel insights to the nursing field by addressing the unique mental health needs of nursing students, a population that faces both academic stress and emotional challenges. By targeting loneliness through mindfulness, this study provides a potential framework for developing mental health interventions that are tailored to the specific challenges faced by nursing students. Additionally, this study is grounded in the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), which emphasizes the role of emotional regulation and coping strategies in managing stressors like loneliness. This theoretical framework supports the hypothesis that mindfulness can help nursing students regulate emotional distress and improve their emotional adaptation, enhancing both their mental health and academic performance. Therefore, this study aimed to examine changes in loneliness among nursing students before and after a brief mindfulness intervention delivered over two weeks.

Methods

Study Design

This study employed a one-group pretest-posttest design, which is commonly used in pilot studies and interventions where a comparison group is not feasible.

This design allows us to assess changes in loneliness scores before and after the mindfulness intervention. However, we acknowledge that this design limits internal validity, because there is no control group, making it difficult to draw causal conclusions. The TREND EQUATOR was followed to ensure transparency and rigor in reporting the intervention, consistent with best practices for non-randomized intervention studies.

Participants and Sampling

Participants were selected using convenience sampling, focusing on nursing students who were available and willing to participate in the study. An *a priori* sample size estimation was conducted using G Power for a paired sample t-test, as the primary analysis compared loneliness scores within the same participants before and after the intervention. The calculation assumed a two-tailed alpha of 0.05, statistical power of 0.90, and a moderate expected effect size of $d_z = 0.40$, which is commonly used in brief psychosocial interventions targeting emotional outcomes in student populations. Based on these assumptions, the minimum required sample size was $n = 68$ participants with complete paired data. To anticipate possible non-completion of posttests or session absence, the target sample size was increased to $n = 85$. A total of 85 nursing students participated in the study. These students were selected based on their availability and willingness to participate, with 29.8% reporting severe loneliness and 70.2% reporting moderate loneliness.

Intervention Fidelity

The mindfulness intervention, developed by the Mental Health Nursing Team at Universitas Diponegoro, was conducted over two weeks, with four 60-minute sessions held weekly. The intervention focused on mindfulness techniques, such as body scan meditation, breathing exercises, and mindful walking. Fidelity of the intervention was monitored through attendance records and feedback forms completed at the end of each session. Participants were also encouraged to practice mindfulness daily at home, and adherence to this was tracked using self-reported logs submitted weekly.

The intervention was validated by an expert in the field, specifically a certified nursing faculty member

with specialization in mental health and mindfulness. The expert reviewed the content to ensure that the mindfulness techniques were scientifically sound and aligned with established practices. This validation process ensured that the intervention was based on credible, evidence-based approaches, enhancing its scientific merit.

The structured mindfulness intervention program aimed to help participants manage loneliness through mindfulness techniques designed to enhance self-awareness and emotional regulation skills. In the first week, participants were trained to develop full awareness of the present moment through practices, such as body scan meditation and daily breathing exercises. The main goal of the first session was to help participants recognize their feelings of loneliness and improve attention control. The second session focused on emotion regulation through mindfulness, where participants learned to recognize their emotions without judgment using techniques, such as body scan meditation, breathing exercises, and mindful walking. This practice aimed to reduce negative reactions to loneliness and help participants manage their emotions more effectively.

In the second week, the third session aimed to enhance self-acceptance and compassion through loving-kindness meditation and self-compassion practices, helping participants reduce negative feelings toward themselves related to loneliness. The final session focused on improving interpersonal communication skills, where participants learned to apply mindfulness to social interactions through mindful communication techniques and empathy-building exercises. At the end of the program, participants were asked to plan how they would continue their daily mindfulness practice and reflect on the insights that they gained from the program.

The attendance rate for the intervention was 85%, with no dropouts. Home practice adherence was moderate, with 70% of participants completing at least 4 out of 7 daily practices each week. To ensure quality delivery, the facilitator conducted a brief check-in at the beginning of each session to discuss experiences and reinforce the importance of daily practice.

Outcome Measurement and Timing

Loneliness was measured using the University of California Los Angeles (UCLA) Loneliness Scale,

version 3, a 20 item self-report instrument widely used to assess perceived loneliness. Each item is rated on a four-point frequency scale ranging from 1 to 4, and item scores are summed to produce a total score ranging from 20 to 80, with higher scores indicating greater loneliness. The UCLA Loneliness Scale, version 3 has demonstrated good internal consistency in previous studies, with Cronbach's alpha values reported at approximately 0.89 (Russell, 1996), supporting its reliability for use in student populations (Hudiyana et al., 2022). In this study, loneliness levels were categorized for descriptive purposes into low or normal, moderate, and severe levels according to the screening thresholds applied during participant selection. The cut off points used to define each category were as follows: low or normal = 20 to 34, moderate = 35 to 49, and severe = 50 to 80. These categories were used only for descriptive presentation, while statistical analyses were conducted using total continuous scores. Pre-intervention loneliness was measured at baseline, and post-intervention loneliness was assessed immediately after the final session.

Construct Validity of Instrument

The construct validity of the UCLA Loneliness Scale (version 3) has been well-established in prior studies through factor analysis, which supports its ability to accurately measure both emotional and social loneliness. In this study, the scale was translated into Bahasa Indonesia using a back-translation process to ensure both accuracy and cultural relevance. Previous research has also confirmed the construct validity of the UCLA Loneliness Scale in Indonesian populations (Hudiyana et al., 2022), demonstrating its appropriateness for assessing loneliness in the context of this study. As such, the UCLA Loneliness Scale (version 3) was deemed a valid instrument to measure the changes in loneliness levels before and after the intervention.

Data Collection Procedures

Participants were recruited through email invitations and announcements on the university's student portal. They were provided with an information sheet explaining the study's purpose, procedures, and their right to participate voluntarily. Data was collected using an online survey platform (Google Forms), and participants completed the questionnaire remotely. Informed consent was obtained from all participants

prior to their participation. The study was voluntary, and participation was not linked to academic performance. Measures were taken to ensure that participants were not coerced into joining the study, and they had the option to withdraw at any time without any consequences.

Statistical Analysis

Data was analyzed using SPSS, version 26. Descriptive statistics were calculated to summarize the demographic characteristics of the sample and the pretest and posttest loneliness scores. To assess the differences between loneliness scores before and after the intervention, a paired t-test was performed. The effect size was calculated using Cohen's *d*, which is a measure of the standardized mean difference between pretest and posttest scores. Cohen's *d* values were interpreted as follows: a small effect size is considered as $d = 0.2$, a moderate effect size is $d = 0.5$, and a large effect size is $d = 0.8$. In our study, we report a moderate effect size of $d = 0.5$, indicating a meaningful reduction in loneliness post-intervention.

Ethical Considerations

This study received ethical approval from the Ethical Committee of Universitas Diponegoro (No. 330/EC/KEPK/FK-UNDIP/VII/2023). Participants received written study information and provided informed consent prior to participation. Confidentiality and anonymity were maintained by using coded identifiers and restricting data access to the research team. Participants were informed that participation was voluntary and that they could withdraw at any time without academic consequences.

Results

This section presents the results of the study, including the characteristics of the participants, the distribution of loneliness levels before and after the intervention, the normality test of loneliness scores, and the results of the paired sample t-test.

Table 1 summarizes the demographic characteristics of the participants. The majority of participants were female (94.1%), and the majority identified as Javanese (83.5%), followed by NTT (8.2%), Sunda (4.7%), and other ethnic groups (3.6%).

Table 1. Characteristics of participants (undergraduate nursing students, $n = 85$)

Category	n	%
Gender		
Male	5	5.9
Female	80	94.1
Ethnicity		
Java	71	83.5
Sunda	4	4.7
Batak	0	0.0
Miscellaneous	3	3.6
NTT	7	8.2
Total	85	100.0

Table 2 shows the frequency distribution of loneliness levels at the pretest and posttest. There was a significant shift in the distribution of loneliness categories, with the proportion of participants in the Low/Normal category increasing from 8.2% to 31.8% and the proportion in the Moderate category decreasing from 84.7% to 61.2%. The proportion classified as Severe remained unchanged at 7.1%.

Table 2. Frequency distribution of loneliness levels at pretest and posttest ($n = 85$)

Loneliness Level	Pretest n	Pretest %	Posttest n	Posttest %
Low/Normal	7	8.2	27	31.8
Moderate	72	84.7	52	61.2
Severe	6	7.1	6	7.1
Total	85	100.0	85	100.0

Note: Loneliness categories were defined using UCLA Loneliness Scale, version 3 total scores: Low/Normal = 20-34, Moderate = 35-49, Severe = 50-80.

The Kolmogorov-Smirnov test was conducted to assess the normality of the loneliness scores. The results indicated that the scores were approximately normally

distributed, with a *p*-value of 0.200. Since the *p*-value was greater than 0.05, we concluded that the data did not significantly deviate from normality. This suggests that

a parametric paired sample t-test was appropriate for further analysis of the pretest and posttest loneliness scores.

Table 3 presents the results of the paired sample t-test. There was a statistically significant reduction in loneliness scores after the mindfulness intervention ($p = 0.001$). The mean loneliness score decreased from 37.45

(SD = 6.53) at pretest to 33.81 (SD = 8.21) at posttest, corresponding to a mean reduction of 3.64 points. The effect size was calculated using Cohen's d and was found to be $d \approx 0.49$, indicating a small-to-moderate magnitude of change in loneliness scores following the intervention.

Table 3. Paired sample t-test results (undergraduate nursing students, $n = 85$)

Group	Mean Difference (Pre-Post)	Pretest Mean $\pm$ SD	Posttest Mean $\pm$ SD	p	Effect Size
Undergraduate Nursing Students	3.64	37.45 $\pm$ 6.53	33.81 $\pm$ 8.21	0.001	Cohen's $d \approx 0.49$

Note: Cohen's d was estimated using the average standard deviation method: $d = (M_{pre} - M_{post}) / [(SD_{pre} + SD_{post})/2]$, resulting in $d \approx 0.49$, which indicates a small-to-moderate magnitude of change.

Discussion

The present study provides preliminary evidence of a reduction in loneliness scores following a brief mindfulness intervention, although causal conclusions cannot be drawn due to the one-group pretest-posttest design. The intervention duration of two weeks may seem brief, and the observed reduction in loneliness scores could be influenced by factors, such as exposure to academic stress or the exam period. It is possible that the observed improvements in loneliness scores were partially due to these external factors. However, we believe that the mindfulness intervention did play a significant role in enhancing emotional regulation and addressing loneliness. Mindfulness training can cultivate interpersonal skills that support more adaptive social perception and interaction (Lindsay et al., 2019). Acceptance training, a core element of mindfulness, may reduce biological stress reactivity to social evaluation threats, which in turn supports engagement in social contexts rather than withdrawal (Lindsay et al., 2018). Mindfulness may also reduce maladaptive cognitive patterns, such as rumination and negative interpretations of social cues, which can perpetuate loneliness. Through acceptance and non-judgment, individuals may relate to loneliness as a temporary emotional state rather than a fixed personal deficit.

The gender distribution in this study, with approximately 80% of participants being female, aligns with the typical composition of nursing programs. Research has consistently shown that nursing education tends to attract a predominantly female population. Nursing programs globally, including in Indonesia, are often composed of a higher percentage of female

students compared to other fields of study (Andargeery et al., 2025). This demographic trend is consistent across various educational institutions, making the preponderance of female participants in this study expected and reflective of the broader gender distribution in nursing education (Bakkar et al., 2024; Manyeneng & Pilusa, 2024). Therefore, the disproportionate gender representation does not constitute a selection bias, but rather reflects the nature of the nursing student population.

As for the decision not to collect demographic variables, such as age and study level, this was intentional, as the study focused primarily on psychosocial outcomes, specifically the reduction of loneliness through mindfulness interventions. Previous research has shown that psychosocial factors like loneliness can be independent of certain demographic variables, particularly in studies targeting emotional and mental health outcomes (El-Monshed et al., 2022; Labrague, 2023). The distinction between bridge and regular students was made, because it was anticipated that these groups might have different levels of prior clinical experience, which could influence their emotional responses and engagement with the mindfulness intervention (Turan et al., 2020).

This study found a statistically significant reduction in loneliness scores following a brief mindfulness intervention. However, the one-group pretest-posttest design limits causal inferences, as changes in loneliness may be influenced by factors, such as maturation, regression to the mean, or external events, like academic stress during the two-week intervention period (Loades et al., 2021). Although mindfulness may have played a

role in reducing loneliness, the absence of a control group means that the observed effects could have been due to other external factors rather than the intervention alone (French et al., 2020). This limitation underscores the need to interpret these findings with caution, as the true impact of mindfulness on loneliness cannot be definitively established with this design.

Mindfulness may have contributed to loneliness reduction by enhancing self-awareness and promoting acceptance. By becoming more aware of their thoughts and emotions, students may have been better equipped to manage feelings of loneliness adaptively (Eccles et al., 2020; Hikmat et al., 2024). Mindfulness training, likely supported interpersonal functioning by encouraging non-judgmental awareness in social interactions, which may have led to a stronger sense of connection (Yosep et al., 2023). However, variables, such as empathy, communication skills, and emotional intelligence, which could further explain improvements in social functioning, were not assessed in this study, and conclusions about their potential impact should be interpreted with caution (Cooper et al., 2021; Weinstock et al., 2021).

The study's sample was predominantly female and Javanese, which limits the generalizability of the findings. In particular, cultural factors, such as religious coping mechanisms and the influence of local social norms around emotional expression, could interact with mindfulness interventions in ways that affect their outcomes. The results may not be representative of other nursing programs or student populations in different regions or cultural contexts, highlighting the need for more diverse and inclusive research in this area. In addition, this study did not formally assess intervention fidelity or adherence to the mindfulness practices, such as session attendance or home practice completion. These factors are important for understanding how the intervention was implemented and how they may have influenced the results. Without monitoring these variables, it is difficult to gauge the full effectiveness of the intervention or its reproducibility.

Mindfulness may influence loneliness through emotional processes, including affective balance. Prior studies indicated that mindfulness can enhance emotional adaptation by increasing positive affect and decreasing negative affect, which may indirectly reduce stress and loneliness (Zhang et al., 2018). Mindfulness may also reduce perceptions of social threat and pressure

by fostering non-reactive attention to distressing thoughts, thereby weakening maladaptive cognitions that contribute to loneliness (Cooper et al., 2021). The discussion of neurobiological pathways, including dopamine, oxytocin, and vasopressin, should be interpreted cautiously, because these mechanisms were not measured in the current study. Nevertheless, prior literature has suggested that oxytocin-related processes may be relevant to trust, stress regulation, emotion recognition, and prosocial behavior, which are conceptually linked to loneliness experiences (Muzi et al., 2022).

Loneliness is commonly described as an unpleasant experience arising when social relationships are perceived as insufficient, including reduced intimacy or companionship (Khatcherian et al., 2022). A meta-analysis has reported increases in loneliness over time in adult populations, indicating that loneliness is a growing public health concern (Buecker et al., 2021). Loneliness is also associated with psychological and physical outcomes, including physiological stress responses and mental health difficulties (Fu et al., 2024; Zheng et al., 2024). Previous studies have examined associations between loneliness and neuroendocrine, immune, and cardiovascular functioning, and loneliness has been linked with higher blood pressure and impaired immune activity in prior studies (Gong et al., 2024; Hikmat et al., 2025). Epidemiological evidence has also associated loneliness with morbidity and mortality outcomes in broader populations (Shi et al., 2024). Feelings of loneliness may lead individuals to withdraw and perceive social environments as threatening, increasing vulnerability to depressive symptoms, although loneliness may also motivate reconnection under certain conditions (Dong, 2024; Fu et al., 2024).

Mindfulness may contribute to loneliness-related outcomes through several psychological processes that are particularly relevant in student populations. One important pathway is self-awareness, which enables individuals to recognize loneliness-related thoughts, emotions, and bodily sensations as they arise (Le et al., 2020). By strengthening moment-to-moment awareness, mindfulness may reduce avoidance and promote more deliberate coping responses, supporting emotional regulation and potentially reducing the frequency or intensity of loneliness experiences (Bonardi et al., 2022; Watkins et al., 2022). Rather than eliminating loneliness, mindfulness may change how individuals

respond to loneliness by increasing tolerance for discomfort and decreasing reactive behaviors that maintain social disconnection (Salmoirago-Blotcher et al., 2018). Another relevant pathway is the acceptance and non-judgmental stance cultivated through mindfulness, which may reduce self-blame and negative self-evaluation that commonly accompany loneliness (Las Hayas et al., 2019). This approach may lessen the emotional burden of loneliness and reduce secondary distress, such as shame or self-criticism, that can exacerbate withdrawal (Yogeswaran & El Morr, 2021; Zhang et al., 2018).

Mindfulness may also support the formation and maintenance of social connections by improving emotional regulation and interpersonal communication. Students who regulate emotions more effectively may experience fewer interpersonal conflicts and may engage in more empathic and authentic interaction, which can strengthen perceived social support (Fish & Saul, 2019). Improved social engagement may reduce perceived isolation and support a greater sense of belonging (Dorais & Gutierrez, 2021; Reid, 2013). In addition, mindfulness practices have been linked to reductions in stress and anxiety, which are frequently associated with loneliness and can contribute to avoidance of social situations (Shapira et al., 2021). When students experience lower stress reactivity, they may be more willing to engage in social interaction and seek support, which is relevant to loneliness reduction processes (Godara et al., 2021a; Zhang et al., 2022). Lastly, mindfulness has been associated with improved emotional well-being and reductions in depressive symptoms, which may help students cope more effectively with loneliness-related distress and maintain adaptive functioning (Zhang et al., 2019).

Implications for Nursing

Mindfulness-based interventions offer valuable strategies for addressing loneliness and improving mental health among nursing students. Given the high levels of emotional distress and academic pressure in nursing programs, integrating mindfulness practices into the curriculum could support students' emotional well-being and enhance their coping skills. Specifically, mindfulness can help students manage stress, regulate emotions, and build resilience, which is crucial for both academic success and effective clinical practice. Moreover, incorporating mindfulness into nursing

education could help students develop interpersonal skills, such as empathy and active listening, which are essential for effective patient care. Nursing educators may consider incorporating mindfulness techniques into classroom activities, clinical preparation, or peer support programs to enhance students' emotional and social functioning.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the one-group pretest-posttest design without a control group limits causal inference, as observed changes may be influenced by maturation, regression to the mean, or external events during the two-week period. Second, loneliness was measured using self-report, which is prone to response biases, such as social desirability, acquiescence, and extreme or neutral responses. Third, outcomes were assessed immediately after the intervention, and no follow-up measurements were conducted, which limits our ability to determine whether the effects of the intervention are sustained over time. The sustainability of the observed changes cannot be determined without follow-up assessments at multiple time points. Fourth, the study did not formally assess intervention fidelity or adherence, such as session attendance, home practice completion, or facilitator checks, which could affect reproducibility and interpretation. Lastly, the sample was drawn from a single institution and was predominantly female and Javanese, which may limit the generalizability of the findings to other nursing programs, regions in Indonesia, or different cultural contexts.

Future Directions

Future studies should evaluate mindfulness interventions for loneliness using controlled designs, such as randomized controlled trials, attention-matched controls, or waitlist control designs, to strengthen causal inference. Follow-up assessments at least at one month and three months' post-intervention are needed to determine whether changes are sustained and to identify whether booster sessions are required. In addition, future research should incorporate fidelity and adherence indicators, including facilitator protocol checklists, session attendance, and home practice monitoring, because these factors may explain variability in outcomes. It is also important to test plausible

mechanisms by measuring emotion regulation, rumination, self-compassion, and interpersonal functioning, so that the pathways linking mindfulness practice to loneliness can be evaluated empirically. Finally, replication in diverse nursing programs and broader Indonesian student populations, as well as cross-cultural comparisons, would clarify generalizability and help refine culturally responsive intervention components.

Conclusions

This study found a statistically significant decrease in loneliness scores among nursing students following participation in the mindfulness intervention. While the results suggest a potential benefit, the use of a one-group pretest-posttest design without a control group limits the ability to draw definitive conclusions about causality. Mindfulness may have contributed to reducing loneliness by enhancing self-awareness and acceptance, although these mechanisms were not directly measured in this study. Future research should use controlled designs, such as randomized controlled trials and include follow-up assessments to determine the sustainability of these effects over time. Incorporating fidelity and adherence monitoring will be crucial in

assessing the long-term impact of mindfulness interventions. Overall, this study provides preliminary evidence that can inform the development of mental health support strategies for nursing students, though further research is needed to confirm these findings and explore their broader applicability.

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Conflict of Interests

The authors declare that they have no conflict of interests regarding this research.

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Author Contributions

Study Design: **MD, SU, RH**. Data Collection: **SU, DYW, AS**. Data Analysis: **MD, MA, RW**. Study Supervision: **MD, RH**. Manuscript Writing: **MD, SU, DYW**. Critical Revision for Important Intellectual Content: **MD, MA, RH**.

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