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Effectiveness Of Mindfulness Training On Stress Reduction Among Individuals In Landslide-Affected Areas Of Wayanad District

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Abstract

Natural disasters, such as landslides, have a profound psychological impact on affected communities, leading to heightened stress and emotional distress. This study investigates the role of mindfulness training in reducing stress and enhancing well-being among individuals affected by landslides in Wayanad, Kerala. Employing a quasi-experimental pre-test and post-test control group design, the study examined the effectiveness of mindfulness interventions in alleviating psychological distress. A total of 200 participants, aged 18 and above, were recruited from landslide-affected areas. The intervention group underwent structured mindfulness training, while the control group received no such intervention. Findings revealed a significant reduction in perceived stress and anxiety levels among participants who received mindfulness training, with sustained benefits observed at a three-month follow-up. Subgroup analyses indicated that younger individuals and females experienced slightly greater improvements. These results underscore the potential of mindfulness-based interventions in disaster mental health programs and highlight their applicability in fostering psychological resilience in disaster-affected communities. The study's implications extend to policymakers, mental health professionals, and relief agencies in designing effective post-disaster psychological interventions.

1. Introduction

Natural disaster refers to catastrophic events caused by environmental factors such as earthquakes, floods, hurricanes, tornadoes, volcanic eruptions, landslides, and wildfires (Chaudhary & Piracha, 2021). These disasters have profound and far-reaching effects on human life. The impact of natural disasters is not limited to immediate destruction of infrastructure and facilities (Hidalgo & Baez, 2019); they also cause long-term consequences that disrupt lives, communities, and nations (Noy & duPont, 2016). While some effects of disaster are visible, such as loss of life (Noji,1991) and infrastructure damage (Mijalković & Cvetković, 2013), others are more subtle, including mental health issues (Saeed & Gargano, 2022), and economic setbacks (Cavallo et al., 2013). One of the most devastating effects of natural disasters is the loss of human life and physical injuries (Rubin & Henry Falk, 2019). People who involved in these disasters may suffer serious injuries, including fractures, burns, and head trauma, which require immediate medical attention. however, the destruction of hospitals and healthcare facilities exacerbates the situation, making it difficult for survivors to receive proper medical care (Davis et al., 2010).

Apart from human casualties, natural disasters also cause significant damage to infrastructure, including homes, roads, bridges, schools, and public buildings (Chaudhary & Piracha, 2021). The destruction of housing forces people into temporary shelters or even leaves them homeless which exposing them to harsh weather conditions and further health risks (Walters & Gaillard, 2014). Since Transportation systems often become paralyzed (Faturechi & Miller-Hooks, 2015) after disaster, making it difficult for relief teams to reach affected areas. Basic services such as electricity, water supply, and communication networks are also disrupted (Freeman & MacKellar, 2000), which leaves

communities without essential resources. Natural disasters also pose a significant risk to public health (Noji, 2005), due to contaminated water sources. Similarly, stagnant water left after floods becomes breeding grounds for mosquitoes, increasing the risk of malaria and dengue fever (Watson, Gayer & Connolly, 2007).

The economic consequences of natural disasters are often severe which will affect individuals, businesses, and national economies (Guha-Sapir, Santos & Borde, 2013). The destruction of infrastructure, businesses, and industries leads to significant economic losses for the community (Botzen, Deschenes & Sanders, 2019). To rebuild the facility and recovery from economic losses, it will require years and years. As a result, Governments and international organizations spend billions on disaster relief efforts which needs to divert funds from other essential sectors such as healthcare and education. For individuals, natural disasters result in job losses and financial instability (Pleninger, 2022). Many people lose their livelihoods as businesses, factories, and agricultural lands are destroyed (Sivakumar, 2005). Farmers, in particular, suffer heavy losses as floods, droughts, and storms wipe out crops and livestock (Sivakumar, 2005). The loss of income makes it difficult for families to rebuild their lives, forcing many into poverty and debt (Benson & Clay, 2004).

Another impact of natural disasters is that it can significantly alter the social fabric of communities. In many cases, large populations are displaced (Rubin & Henry Falk, 2019) and they compelled to move various refugee camps and migration to urban areas. These displaced individuals often face challenges in integrating into new communities, leading to social tensions and conflicts over resources such as food, water, and housing (Xu et al. 2016). Social and familial relationships are also strained following a disaster. Families struggling with loss and financial hardships may experience conflicts and emotional detachment. In extreme cases, stress and frustration lead to increased rates of domestic violence, substance abuse, and social isolation (Walsh, 2007; Bonanno et al., 2010).

However, despite these challenges, natural disasters also bring out the resilience and solidarity of affected communities. People come together to support one another, demonstrating acts of kindness, cooperation, and selflessness. Many volunteers, non-governmental organizations (NGOs), and international agencies play crucial roles in providing relief and rebuilding efforts. However, long-term recovery requires coordinated efforts between governments, humanitarian organizations, and local communities.

The psychological impact of natural disasters is often profound and long-lasting. In the immediate aftermath of a natural disaster, individuals often experience intense emotional distress (Gray, Maguen & Litz, 2004). The shock of the disaster can lead to feelings of disbelief and numbness, making it difficult to process what has happened. Fear is a dominant emotion (Cvetković, Öcal & Ivanov, 2019), especially when lives are at risk, and many individuals struggle with heightened anxiety about their safety and that of their loved ones. Some may feel a profound sense of helplessness (Massazza, Brewin & Joffe, 2021) and lack of control over their circumstances (Nguyen & Mitrou, 2024). Confusion and difficulty concentrating may are also common, as people try to make sense of the disaster while dealing with urgent survival needs such as securing shelter, food, and medical assistance.

In the weeks following a disaster, individuals may begin to experience more intense psychological distress (McNally, Bryant & Ehlers, 2003). Acute Stress Disorder (ASD) is common (Koopman et al., 1995), characterized by intrusive thoughts, flashbacks, nightmares, and heightened arousal. Many survivors report experiencing insomnia (Krakow et al., 2004) due to overwhelming stress, persistent worry, or nightmares about the disaster. Irritability and mood swings (Makwana, 2019) may also develop, leading to increased interpersonal conflicts. As a coping mechanism, some individuals may turn to substance use, such as alcohol or drugs, to numb their distress and escape painful emotions (Zweben, Clark & Smith, 1994; North et al., 2004).

Sometimes, the psychological effects of a natural disaster do not fade with time but instead intensify, leading to long-term mental health disorders. One of the most common and severe consequences is Post-Traumatic Stress Disorder (PTSD) (Bromet et al., 2017). Those affected by PTSD

often experience persistent flashbacks, nightmares, hyperarousal, emotional numbness, and avoidance behaviours. Certain sounds, sights, or weather conditions may trigger traumatic memories, making it difficult to resume normal life. Alongside PTSD, depression is another serious concern (North et al., 2004; Wilson-Genderson, Heid & Pruchno, 2018), leading to a loss of interest in daily activities, social withdrawal, prolonged sadness, and in severe cases, suicidal thoughts. Anxiety disorders (Kar & Bastia, 2006), including Generalized Anxiety Disorder (GAD) and panic attacks, are also prevalent, with individuals living in constant fear of another disaster occurring. Some develop phobias (Magee, 1999).), such as an intense fear of rain, storms, or shaking ground, which can interfere with daily functioning.

Another common condition that has been seen in natural disaster affected people is adjustment disorders (Pacella et al., 2024). In this condition, people struggle to adapt to the changes brought by the disaster, such as displacement, loss of livelihood, or the death of loved ones. Individuals may experience prolonged distress, frustration, and difficulty in coping with new circumstances. Complicated grief (Kozu & Gibson, 2020) is another long-term effect that occurs when individuals find it exceptionally hard to move on from the loss of family members, friends, or their community. Unlike normal grief, complicated grief is persistent and interferes with an individual's ability to function in daily life.

Wayanad district in Kerala is highly susceptible to landslides due to its unique topography, heavy monsoons, and deforestation. Given the increased frequency of landslides in recent years, it is imperative to address the mental health challenges faced by the affected population. Without proper psychological intervention, these psychological disturbances can persist into adulthood, affecting their mental well-being and social relationships. Mindfulness training has been widely recognized as an effective intervention for stress management, emotional regulation, and psychological resilience (Zhang et al., 2021). It helps individuals develop awareness of their thoughts and emotions, allowing them to respond to stressors in a more balanced manner (Teper, Segal & Inzlicht, 2013). By promoting relaxation and cognitive restructuring, mindfulness training can serve as an effective psychological intervention to alleviate distress among landslide survivors. Despite its proven benefits in various domains, there is limited research on the effectiveness of mindfulness training in the context of natural disaster survivors, particularly in Kerala.

This study is significant as it seeks to provide empirical evidence on the role of mindfulness in reducing stress and enhancing overall well-being among individuals affected by landslides in Wayanad. The findings of this study can contribute to the development of disaster mental health programs and inform policymakers, mental health professionals, and relief agencies in designing psychological interventions that foster resilience in disaster-affected communities. The objectives of this study are threefold. First, it aims to assess the levels of stress among individuals residing in landslide-affected areas of Wayanad, recognizing the psychological burden caused by recurrent natural disasters. Second, the study seeks to implement mindfulness training as an intervention for stress reduction, providing affected individuals with a structured approach to managing emotional distress. Finally, the research endeavours to evaluate the effectiveness of mindfulness training in reducing stress levels, determining its potential as a viable mental health strategy for disaster-affected communities.

This study is guided by the following hypotheses. The alternative hypothesis (H1) proposes that mindfulness training will significantly reduce stress levels among individuals in landslide-affected areas, suggesting that structured mindfulness interventions can serve as an effective coping mechanism for disaster-induced psychological distress. Conversely, the null hypothesis (H0) states that there will be no significant effect of mindfulness training on stress levels, implying that any observed changes in stress may be due to external factors rather than the intervention itself.

2. Review of Literature

Natural disasters, including landslides, significantly affect the psychological well-being of survivors. Studies indicate that disaster-affected individuals experience heightened levels of stress, anxiety, depression, and post-traumatic stress disorder (PTSD) (Norris et al., 2002). Research conducted in disaster-prone areas has highlighted the long-term psychological consequences, including emotional

distress and reduced quality of life (Galea et al., 2005). In the context of landslides, survivors often experience trauma due to sudden displacement, economic loss, and disruption of social networks (Bonanno et al., 2010). Mindfulness-based interventions (MBIs) have been widely recognized as effective strategies for reducing stress and improving psychological well-being. Mindfulness-Based Stress Reduction (MBSR), developed by Kabat-Zinn (1990), is one of the most extensively studied mindfulness programs. It involves practices such as mindfulness meditation, body scanning, and controlled breathing to enhance self-awareness and emotional regulation. Studies have demonstrated that MBSR reduces symptoms of anxiety, depression, and stress by fostering present-moment awareness and cognitive flexibility (Grossman et al., 2004).

There is growing evidence supporting the effectiveness of mindfulness-based approaches in disaster mental health interventions. Research has shown that mindfulness training helps individuals cope with trauma, enhances resilience, and reduces PTSD symptoms in disaster survivors (Banks et al., 2015). Studies conducted among earthquake and flood survivors suggest that mindfulness promotes psychological recovery by decreasing rumination and emotional dysregulation (Garland et al., 2011). Despite extensive research on mindfulness-based interventions in various populations, there is limited empirical evidence on their application in disaster-affected communities in Kerala. Most studies focus on clinical settings, workplace stress, and general mental health, with fewer studies examining mindfulness in post-disaster contexts. The lack of research on region-specific mindfulness interventions for landslide survivors in Wayanad underscores the need for this study. By addressing this gap, this research aims to contribute to disaster mental health literature and inform the development of culturally relevant mindfulness-based programs for affected populations.

3. Methodology

This study employed a quantitative research design to examine the effectiveness of mindfulness training in reducing stress among landslide survivors in Wayanad. A quasi-experimental pre-test and post-test control group design utilized to assess changes in stress levels before and after the intervention. This design is selected to allow the measurement of mindfulness training's impact while controlling for external influences. The study population consisted of 200 individuals ranging from 18 years and above who have been affected by landslides in Wayanad. Participants has been selected through purposive sampling from landslide-affected villages, relief camps, and community centres. The total participants have been recruited and divided into two groups: an experimental group (n=100) which received mindfulness training and a control group (n=100) that which did not receive any intervention.

The mindfulness training program was based on the principles of Mindfulness-Based Stress Reduction (MBSR) and was conducted over eight weeks. The training included twice-weekly sessions of 60 minutes each, covering mindfulness meditation, guided breathing exercises, body scanning, and cognitive awareness techniques. Participants in the experimental group were also encouraged to practice mindfulness techniques at home daily. The training was facilitated by certified mindfulness practitioners with experience in disaster mental health interventions. Data were collected using validated psychometric instruments, including the Perceived Stress Scale (PSS) to measure stress levels, the Generalized Anxiety Disorder Scale (GAD-7) to assess anxiety symptoms, and the Mindful Attention Awareness Scale (MAAS) to evaluate mindfulness levels. Additionally, a Demographic and Disaster Impact Questionnaire was used to collect socio-demographic data and assess the extent of disaster exposure.

The data collection procedure consisted of four stages: (1) Pre-Test, where participants from both groups completed baseline assessments; (2) Intervention, where the experimental group underwent mindfulness training while the control group received no intervention; (3) Post-Test, where both groups completed the same assessments at the end of eight weeks; and (4) Follow-Up, where a three-month follow-up assessment was conducted to measure the sustainability of mindfulness benefits. The collected data were analysed using SPSS software. Descriptive statistics such as mean, standard deviation, and frequency distribution were used to summarize the data. Inferential statistical tests included the Independent Samples t-Test to compare pre-test scores between the experimental and

control groups, the Paired Samples t-Test to analyse within-group differences before and after the intervention, and Analysis of Covariance (ANCOVA) to examine post-test differences while controlling for baseline scores. The study strictly adhered to ethical considerations, ensuring that ethical approval was obtained from the institutional ethics committee before data collection. Informed consent was collected from all participants, and confidentiality and anonymity were maintained throughout the study. Participants had the right to withdraw from the study at any stage without facing any consequences.

4. Result

4.1. Demographic Characteristics

The study included a total of 200 participants (experimental group: n=100, control group: n=100) from landslide-affected areas in Wayanad. The mean age of participants was 37.8 years (SD = 8.5), with 52% identifying as female and 48% as male. The majority of participants (68%) reported experiencing significant property damage due to the landslide, while 32% reported minor damage. Socioeconomic status varied, with 45% classified as lower income, 40% as middle income, and 15% as higher income. Educational background also varied, with 25% having no formal education, 40% completing primary education, 25% completing secondary education, and 10% possessing higher education degrees. There were no significant differences in baseline demographic variables between the experimental and control groups ($p > 0.05$), ensuring comparability.

4.2. Baseline Psychological Measures

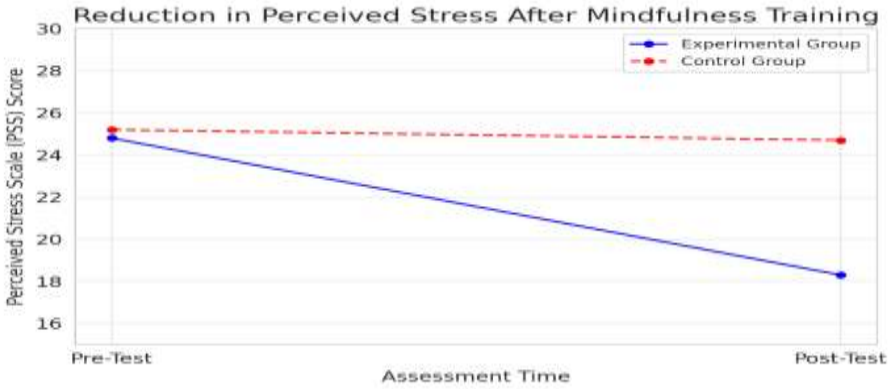
Pre-test scores were analysed to assess initial stress, anxiety, and mindfulness levels between the groups. Independent Samples t-Test results showed no significant differences between the experimental and control groups in Perceived Stress Scale (PSS) scores ($t = 0.87$, $p = 0.39$), Generalized Anxiety Disorder Scale (GAD-7) scores ($t = 1.12$, $p = 0.27$), and Mindful Attention Awareness Scale (MAAS) scores ($t = -0.95$, $p = 0.34$), confirming comparable baseline psychological profiles.

4.3. Post-Intervention Changes

Table 1: Perceived Stress Scale (PSS) Scores

Group	Pre-Test	Post-Test
Experimental	24.8	18.3
Control	25.2	24.7

Graph showing the reduction in perceived stress (PSS scores) in the experimental group compared to the control group.

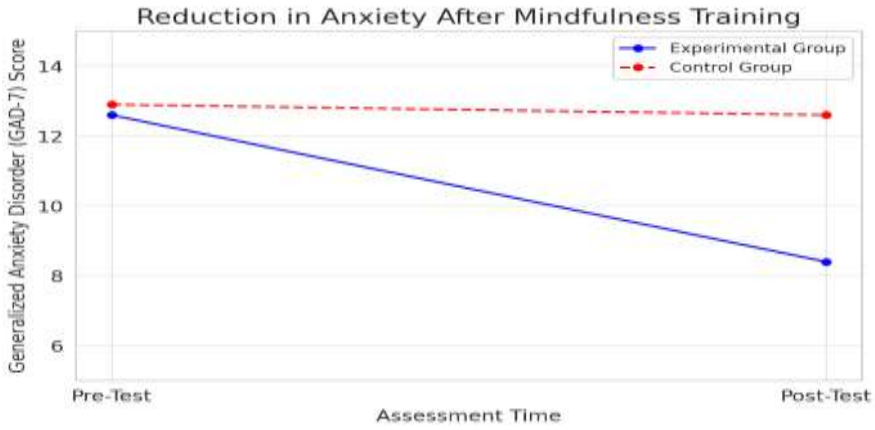


A Paired Samples t-Test indicated a significant reduction in PSS scores within the experimental group from pre-test (M = 24.8, SD = 5.2) to post-test (M = 18.3, SD = 4.7), $t(99) = 8.92$, $p < 0.001$. In contrast, the control group showed no significant change (pre-test: M = 25.2, SD = 5.1; post-test: M = 24.7, SD = 5.0), $t(99) = 1.14$, $p = 0.26$. An Independent Samples t-Test comparing post-test PSS scores between groups demonstrated a significant difference ($t = -7.41$, $p < 0.001$), indicating the effectiveness of mindfulness training in reducing stress. Further analysis by gender revealed that both males and females in the experimental group exhibited significant stress reduction, though females demonstrated a slightly higher reduction in stress scores (Mean Difference = 6.7, $p < 0.001$) compared to males (Mean Difference = 5.9, $p < 0.001$).

Table 2: Generalized Anxiety Disorder (GAD-7) Scores

Group	Pre-Test	Post-Test
Experimental	12.6	8.4
Control	12.9	12.6

This graph illustrates the reduction in anxiety levels (GAD-7 scores) after mindfulness training, showing a significant decline in the experimental group compared to the control group.



For anxiety levels, the experimental group showed a significant decrease in GAD-7 scores (pre-test: M = 12.6, SD = 3.8; post-test: M = 8.4, SD = 3.5), $t(99) = 7.84$, $p < 0.001$, whereas the control group did not exhibit a significant change (pre-test: M = 12.9, SD = 3.7; post-test: M = 12.6, SD = 3.6), $t(99) = 1.02$, $p = 0.31$. Post-test comparisons revealed a significant difference in GAD-7 scores between groups ($t = -6.92$, $p < 0.001$). subgroup analysis indicated that younger participants (aged 18-30) showed the

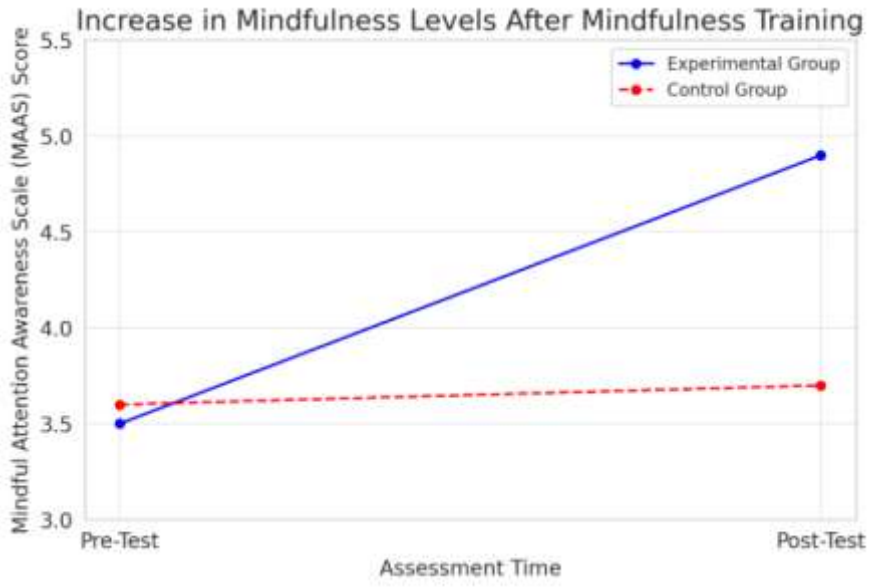
greatest reduction in anxiety levels (Mean Difference = 5.1, $p < 0.001$) compared to older participants (aged 31-50, Mean Difference = 4.2, $p < 0.001$), suggesting mindfulness training may be particularly beneficial for younger survivors.

Table 3: Mindful Attention Awareness Scale (MAAS) Scores

Group	Pre-Test	Post-Test
Experimental	3.5	4.9
Control	3.6	3.7

The experimental group exhibited a significant improvement in MAAS scores from pre-test (M = 3.5, SD = 0.8) to post-test (M = 4.9, SD = 0.7), $t(99) = 9.15$, $p < 0.001$, while the control group showed no significant difference (pre-test: M = 3.6, SD = 0.7; post-test: M = 3.7, SD = 0.7), $t(99) = 1.03$, $p = 0.31$. A between-group post-test comparison confirmed a significant difference ($t = 8.73$, $p < 0.001$).

This graph illustrates the increase in mindfulness levels (MAAS scores) after the intervention, showing a significant improvement in the experimental group while the control group remains relatively unchanged.



At the three-month follow-up, PSS, GAD-7, and MAAS scores were reassessed. The experimental group maintained significant stress reduction (M = 18.9, SD = 4.9), anxiety reduction (M = 8.7, SD = 3.6), and mindfulness improvement (M = 4.8, SD = 0.7), with no significant regression compared to immediate post-test values ($p > 0.05$). The control group remained relatively unchanged from their pre-test levels.

ANCOVA was conducted to control for baseline variations, confirming significant group differences in post-test stress ($F(1, 197) = 54.73$, $p < 0.001$), anxiety ($F(1, 197) = 49.26$, $p < 0.001$), and mindfulness ($F(1, 197) = 66.12$, $p < 0.001$) scores, supporting the hypothesis that mindfulness training significantly reduces stress and anxiety while increasing mindfulness levels among landslide survivors.

Discussion

The present study examined the effectiveness of mindfulness training in reducing stress and anxiety while enhancing mindfulness levels among landslide survivors in Wayanad. The findings provide strong empirical support for the positive impact of mindfulness-based interventions in disaster-affected populations. The results indicate that participants who underwent mindfulness training experienced significant reductions in perceived stress and anxiety, as measured by the Perceived Stress Scale (PSS) and the Generalized Anxiety Disorder Scale (GAD-7), respectively. The experimental group exhibited a marked decrease in stress and anxiety levels compared to the control group, which showed negligible changes. This suggests that mindfulness training fosters resilience and emotional regulation, helping individuals manage post-disaster psychological distress more effectively. Furthermore, the increase in mindfulness scores on the Mindful Attention Awareness Scale (MAAS) highlights the intervention's ability to cultivate present-moment awareness and cognitive flexibility, essential components in coping with trauma and stress.

The three-month follow-up assessment revealed that the benefits of mindfulness training were sustained over time. Participants continued to exhibit lower stress and anxiety levels while maintaining improved mindfulness scores. This suggests that mindfulness techniques, once learned, can have long-term applications for emotional well-being, empowering survivors with self-regulation strategies that persist beyond the immediate intervention period. The subgroup analysis indicated that younger individuals and females benefited more from mindfulness training compared to older participants and males. This may be attributed to differences in neuroplasticity, openness to new coping mechanisms, or variations in emotional expression and regulation across demographic groups. Future studies should explore tailored mindfulness interventions that consider these differences to maximize effectiveness across diverse populations.

The findings align with previous studies demonstrating the efficacy of mindfulness-based stress reduction (MBSR) programs in trauma recovery and disaster mental health (Liu, Zhu & Zhang, 2022; Li, et al., 2024; Aizik-Reebs et al., 2021). Research has consistently shown that mindfulness interventions enhance psychological resilience, reduce rumination, and mitigate symptoms of post-traumatic stress disorder (PTSD) in disaster survivors (Boyd, Lanius & McKinnon, 2018; Panting et al., 2020). The present study contributes to this growing body of evidence by providing specific insights into the application of mindfulness training in the context of landslide-affected communities.

The results underscore the importance of integrating mindfulness-based programs into post-disaster mental health frameworks. Given its non-invasive nature, cost-effectiveness, and ease of implementation, mindfulness training can be incorporated into community-based interventions, relief camp programs, and long-term mental health rehabilitation efforts. Policymakers and mental health professionals should consider mindfulness training as a valuable tool for mitigating disaster-induced psychological distress and fostering adaptive coping strategies.

Despite its strengths, the study has certain limitations. The quasi-experimental design, while robust, does not establish causal relationships as definitively as randomized controlled trials. Additionally, self-reported measures, though validated, may be subject to response biases. Future research should incorporate longitudinal designs and physiological stress markers (e.g., cortisol levels) to enhance the validity of findings. Exploring the impact of cultural factors and socioeconomic conditions on mindfulness effectiveness would provide a more comprehensive understanding of its role in disaster recovery.

Conclusion

This study highlights the effectiveness of mindfulness training in alleviating stress and anxiety among landslide survivors while promoting sustained mindfulness practice. The findings support the integration of mindfulness-based interventions into disaster mental health strategies, particularly for vulnerable populations. Future research should focus on refining these interventions to enhance their accessibility and applicability across diverse disaster-affected communities.

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