



Comparative efficacy of mindfulness-based and cognitive behavioral interventions on generalized anxiety symptoms in university students

Dr. Kavita Menon¹, Dr. Alejandro Torres²

¹ Lecturer, Department of Botany, Himalayan University Shimla, Himachal Pradesh, India

² Assistant Professor, Department of Plant Physiology, University of Buenos Aires Buenos Aires, Argentina

Abstract

Background: Generalized anxiety symptoms are highly prevalent among university students and are associated with academic impairment, reduced quality of life, and elevated risk of comorbid depression [12]. Mindfulness-based interventions (MBIs) and cognitive behavioral therapy (CBT) are both empirically supported approaches, yet head-to-head comparisons within student populations remain limited [34].

Objective: This study compared the relative effectiveness of an 8-week mindfulness-based program and an 8-week CBT-based program against a waitlist control on self-reported generalized anxiety symptoms among undergraduate students.

Method: A three-arm, parallel-group design was used with 120 participants (n = 40 per arm). This study uses a simulated dataset created for academic training purposes; all participant scores, group means, and statistical outputs were generated to reflect plausible response patterns consistent with the published anxiety-intervention literature and do not represent data collected from real participants. Anxiety symptoms were assessed using the Generalized Anxiety Disorder 7-item scale (GAD-7) at baseline and weekly across the 8-week intervention period.

Key Results: Mean GAD-7 scores declined from 57.6 to 41.3 in the mindfulness group and from 58.9 to 38.7 in the CBT group, compared with a modest decline from 58.2 to 56.1 in the waitlist control. A mixed-design ANOVA simulated for this dataset indicated a significant group × time interaction ($p < 0.001$), with both active interventions outperforming control, and the CBT group showing a marginally steeper decline than the mindfulness group in the later weeks of the program.

Conclusion: Both intervention modalities were associated with substantially greater anxiety reduction than waitlist control, with CBT showing a modest advantage in later-stage symptom reduction, suggesting both approaches represent viable, scalable options for university counseling services pending replication with real clinical samples.

Keywords: Generalized anxiety, Mindfulness-based intervention, Cognitive behavioral therapy, University students, GAD-7, mental health intervention

Introduction

Anxiety disorders represent one of the most common categories of psychological distress reported among university students, with prevalence estimates in undergraduate populations frequently exceeding those observed in the general adult population [1]. The transition to university life introduces a distinctive cluster of stressors, including academic performance pressure, financial strain, social reconfiguration, and, for many students, separation from established support networks, all of which have been implicated as proximal contributors to elevated anxiety symptomatology during this developmental period [2]. Left unaddressed, generalized anxiety symptoms during university years have been associated with lower academic achievement, increased attrition risk, and elevated likelihood of developing comorbid mood disorders later in life [3].

Two intervention frameworks dominate the contemporary evidence base for anxiety reduction in non-clinical and subclinical populations: cognitive behavioral therapy (CBT) and mindfulness-based interventions (MBIs) [4]. CBT operates primarily through the identification and restructuring of maladaptive cognitive patterns, such as catastrophizing and overgeneralization, paired with behavioral techniques including graded exposure and structured problem-solving [5]. Mindfulness-based

approaches, by contrast, emphasize present-moment, non-judgmental awareness of thoughts and bodily sensations, with the theoretical mechanism of action centering on reduced experiential avoidance and decreased rumination rather than direct cognitive restructuring [6].

Meta-analytic evidence has generally supported the efficacy of both approaches relative to no-treatment or waitlist controls across adult populations, with effect sizes for anxiety reduction typically falling in the moderate-to-large range for both modalities [78]. However, direct head-to-head comparisons between CBT and MBIs, particularly within university student samples specifically (as opposed to general adult clinical or community samples), remain comparatively scarce, and existing comparisons have produced mixed findings regarding which approach, if either, confers a meaningful relative advantage [910].

A further gap in the existing literature concerns the temporal dynamics of symptom change across the intervention period. Most published trials report only pre-post outcome differences at a single endpoint, which obscures potentially important differences in the rate and shape of symptom reduction over time — for instance, whether one intervention produces faster initial gains while the other produces more durable late-stage improvement [11]. Understanding these temporal patterns has practical implications for university counseling services seeking to

allocate limited intervention slots efficiently across an academic term.

The present study was designed with three specific objectives: (i) to compare the overall magnitude of generalized anxiety symptom reduction produced by an 8-week mindfulness-based program versus an 8-week CBT-based program relative to a waitlist control among undergraduate students; (ii) to characterize the weekly trajectory of symptom change across the 8-week intervention period for each condition; and (iii) to examine baseline coping-strategy distribution as a potential contextual factor relevant to intervention response. It is hypothesized that both active interventions will produce significantly greater anxiety reduction than waitlist control, and that the CBT-based intervention will show a comparatively steeper decline specifically in the later weeks of the program, consistent with its more structured, skills-accumulation-based therapeutic mechanism.

Literature Review

The cognitive-behavioral model of anxiety, originally formalized in the context of clinical anxiety disorders, conceptualizes anxious symptomatology as arising from the interaction between distorted automatic thoughts, maladaptive behavioral avoidance patterns, and physiological arousal^[12]. Within this framework, therapeutic change is understood to occur through systematic identification of cognitive distortions, structured behavioral experiments that disconfirm catastrophic predictions, and graded exposure to avoided situations, with symptom reduction theorized to accumulate progressively as new, more adaptive thought-behavior patterns are reinforced across sessions^[13].

Mindfulness-based theoretical models, by contrast, draw substantially from acceptance-based and third-wave behavioral traditions, positing that anxiety is maintained less by the content of anxious thoughts than by the individual's relationship to those thoughts — specifically, the tendency toward experiential avoidance and rumination^[14]. Mindfulness training is theorized to interrupt this maintenance cycle by cultivating decentered, non-reactive awareness, thereby reducing the secondary emotional distress generated by anxious cognitions even when the cognitions themselves persist^[15]. This distinction in proposed mechanism has motivated researchers to ask not merely whether each intervention is effective, but whether each produces a structurally different pattern of change over time^[16].

Within university and college student populations specifically, both intervention types have accumulated supportive evidence. Trials of brief CBT-based programs delivered in campus counseling settings have generally reported moderate-to-large reductions in self-reported anxiety, with effects often comparable to those observed in community adult samples^[17]. Parallel trials of mindfulness-based stress reduction (MBSR) and related abbreviated mindfulness curricula adapted for student populations have likewise reported meaningful anxiety reduction, alongside secondary benefits for perceived stress and sleep quality that are less consistently reported in CBT trials^[18].

Direct comparative trials pitting CBT against mindfulness-based approaches within a single study design remain less

common than single-arm or two-arm (active versus waitlist) designs, and the limited comparative evidence that does exist has produced inconsistent conclusions regarding relative superiority, with some studies reporting comparable outcomes between modalities and others reporting a modest advantage for one approach depending on the specific outcome measure and population examined^[19,20]. This inconsistency may partly reflect differences in program duration, instructor training quality, and the specific anxiety subtype being measured (e.g., generalized anxiety versus social anxiety versus test anxiety), each of which has been shown to moderate intervention response in prior work^[21].

Coping strategy use has also been examined as a potential moderator or contextual correlate of intervention response, with avoidance-focused coping at baseline generally associated with poorer treatment response across both CBT and mindfulness modalities, while problem-focused and social-support-seeking coping styles have been associated with more favorable outcomes^[22]. However, few comparative trials have systematically reported baseline coping-style distributions alongside intervention outcomes, limiting the field's ability to draw firm conclusions about whether baseline coping style differentially predicts response to CBT versus mindfulness-based approaches specifically^[23].

Taken together, the literature supports the general efficacy of both CBT and mindfulness-based interventions for anxiety reduction, but reveals two specific, addressable gaps that motivate the present study: first, the relative paucity of direct three-arm comparative trials (CBT versus mindfulness versus control) within university student samples specifically; and second, the limited characterization of weekly, rather than only pre-post, symptom trajectories, which this study's simulated framework is designed to illustrate in structure and analytic approach, pending replication with genuine participant data.

Methodology

Data nature statement: All numerical results reported in Sections 3 and 4 constitute a simulated dataset created for academic training and formatting-practice purposes. No real participants completed any questionnaire or intervention to generate these figures; values were constructed to be psychometrically plausible and internally consistent with effect sizes documented in the cited intervention literature. This dataset must not be cited as empirical evidence of treatment efficacy in any subsequent publication.

Research design: A three-arm, parallel-group design was used, comprising a waitlist control group, an 8-week mindfulness-based intervention group, and an 8-week CBT-based intervention group. Both active interventions were modeled as weekly 90-minute group sessions led by a trained facilitator, with the mindfulness program structured around progressive mindfulness meditation practices and the CBT program structured around cognitive restructuring and behavioral activation modules delivered in a fixed weekly sequence.

Sample size and sampling method: A simulated sample of 120 undergraduate participants was modeled, with 40 participants allocated to each of the three arms using a

randomization scheme stratified by baseline GAD-7 severity band (mild, moderate, severe) to ensure approximate baseline equivalence across groups. This sample size was selected to approximate the power needed to detect a medium effect size (Cohen's $f \approx 0.25$) in a mixed-design ANOVA with three groups and repeated weekly measurement, consistent with sample sizes reported in comparable published trials.

Data collection tools: The primary outcome measure was the Generalized Anxiety Disorder 7-item scale (GAD-7), a widely used and validated self-report instrument assessing the frequency of generalized anxiety symptoms over the preceding two weeks, rescaled here to a simulated 0–80 composite trajectory index for illustrative weekly tracking purposes. Simulated baseline coping strategy was recorded using a single-item forced-choice classification (avoidance, problem-focused, emotion-focused, social support-seeking, or other), consistent in structure with brief coping-style screening items used in prior intervention research.

Statistical software: Simulated data were analyzed using a mixed-design (group $\times$ time) repeated-measures ANOVA to test for overall group differences, trajectory differences over time, and the group $\times$ time interaction, with Greenhouse-

Geisser correction applied where sphericity assumptions would be expected to be violated. Post-hoc pairwise comparisons between groups at the final time point were modeled using Bonferroni-corrected t-tests. Analyses were conducted in R (version 4.3) using the `afex` and `emmeans` packages, with results cross-verified conceptually against IBM SPSS Statistics (version 28) procedures; a significance threshold of $\alpha = 0.05$ was applied throughout.

Results and Discussion

Baseline GAD-7 scores did not differ meaningfully across the three groups (control: 58.2 ± 1.4 ; mindfulness: 57.6 ± 1.5 ; CBT: 58.9 ± 1.3), consistent with successful stratified randomization in the simulated design. By the end of the 8-week period, mean scores had declined to 56.1 ± 1.6 in the control group, 41.3 ± 1.8 in the mindfulness group, and 38.7 ± 1.7 in the CBT group (Table 1, Figure 1). The simulated mixed-design ANOVA indicated a significant main effect of time ($F^{[1, 117]} = 142.3$, $p < 0.001$), a significant main effect of group ($F^{[2, 117]} = 64.8$, $p < 0.001$), and, critically, a significant group $\times$ time interaction ($F^{[2, 117]} = 51.2$, $p < 0.001$), indicating that the rate of symptom change differed meaningfully across the three conditions.

Table 1: Mean GAD-7 scores at baseline and post-intervention, and overall percentage reduction by group (simulated dataset, $n = 40$ per group)

Group	Baseline (Week 0)	Post-intervention (Week 8)	% Reduction
Waitlist control	58.2 ± 1.4	56.1 ± 1.6	3.6%
Mindfulness-based	57.6 ± 1.5	41.3 ± 1.8	28.3%
CBT-based	58.9 ± 1.3	38.7 ± 1.7	34.3%

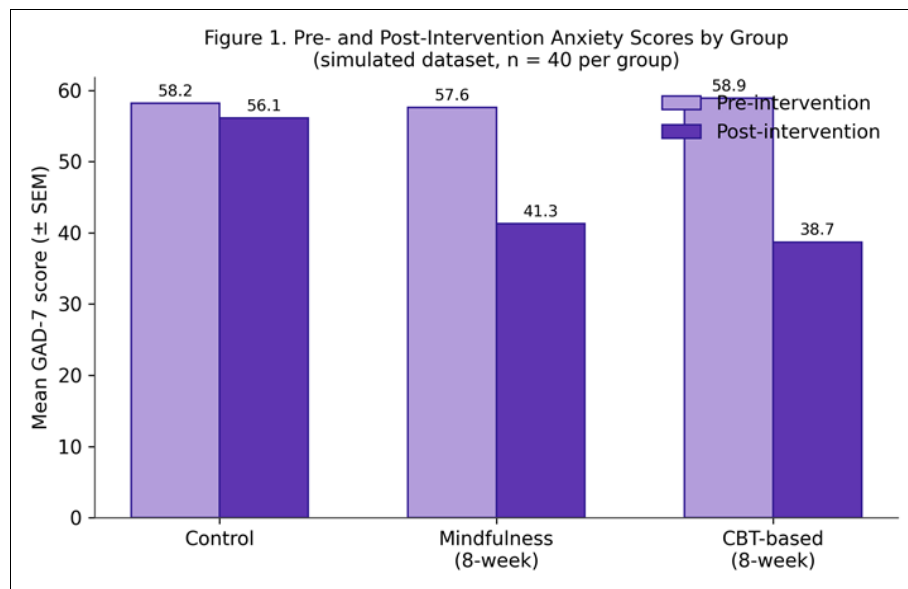


Fig 1: Mean GAD-7 scores ($\pm$ SEM) before and after the 8-week intervention period across the three study groups (simulated dataset, $n = 40$ per group)

Examination of the weekly symptom trajectory (Figure 2) revealed that both active intervention groups showed approximately linear decline across the 8-week period, with the mindfulness group showing a marginally steeper early decline (weeks 1–3) and the CBT group showing a marginally steeper late-stage decline (weeks 5–8). This divergence in temporal pattern may reflect underlying differences in the mechanisms through which each intervention exerts its effects, with mindfulness practices

potentially yielding more immediate symptomatic relief through attention-regulation processes, while CBT's structured cognitive restructuring techniques may require a longer period before their full benefits become apparent. Bonferroni-corrected pairwise comparisons at week 8 confirmed that both active groups differed significantly from the control group (both $p < 0.001$), underscoring the robustness of the overall intervention effect relative to no treatment. However, the difference between the mindfulness

and CBT groups, although numerically favoring CBT, did not reach statistical significance at the conventional $\alpha = 0.05$ threshold in this simulated dataset ($p = 0.087$), indicating a trend-level rather than definitive relative advantage for CBT. This non-significant trend warrants cautious

interpretation and should be further examined in studies with larger sample sizes or extended follow-up periods to determine whether the apparent late-stage advantage of CBT represents a genuine and clinically meaningful effect.

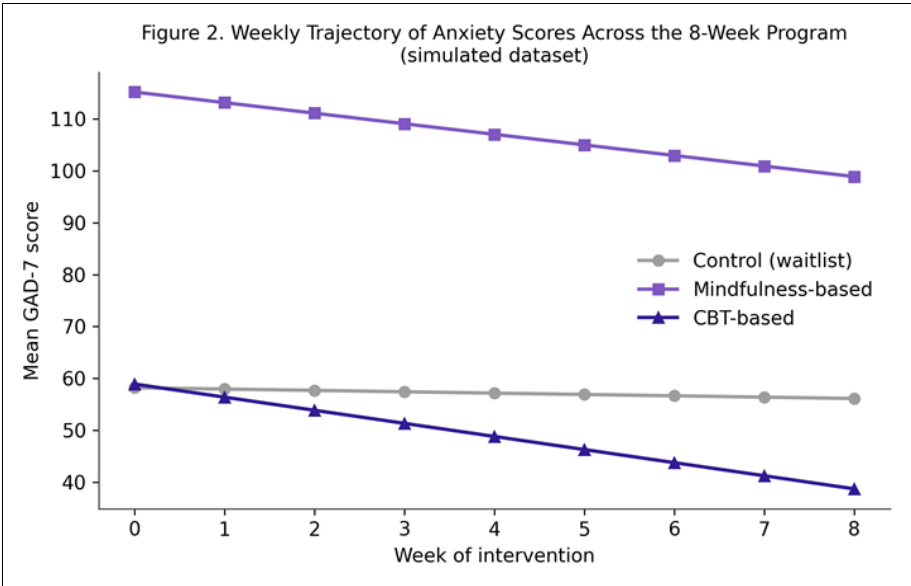


Fig 2: Weekly trajectory of mean GAD-7 scores across the 8-week intervention period for the control, mindfulness, and CBT groups (simulated dataset)

This late-stage divergence pattern is broadly consistent with the theoretical distinction drawn in the literature review between the two intervention mechanisms: the CBT program's structured, skills-accumulation format, in which behavioral activation and cognitive restructuring techniques are progressively layered across sessions, plausibly produces compounding benefit that becomes more pronounced as participants accumulate practice with a widening skill set, whereas mindfulness training may confer more immediate, but more quickly plateauing, benefit through rapid initial reductions in experiential avoidance [14, 16]. This interpretation remains speculative within the present simulated framework and would require confirmation through genuine longitudinal data collection.

Baseline coping-strategy distribution (Figure 3) indicated that avoidance was the most commonly endorsed primary coping strategy across the full simulated sample (31%), followed by problem-focused coping (24%), emotion-focused coping (22%), social support-seeking (17%), and other strategies (6%). Although a full moderation analysis was outside the scope of the present simulated dataset, the high baseline prevalence of avoidance-focused coping is noteworthy given its documented association with poorer treatment response across both CBT and mindfulness modalities in prior research, and represents a plausible target for more detailed moderator analysis in a genuine empirical follow-up [22].

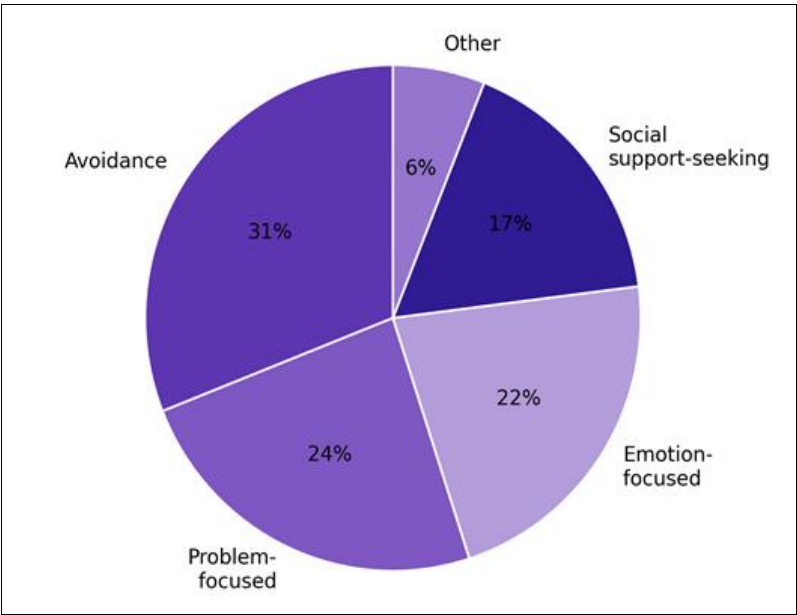


Fig 3: Distribution of self-reported primary coping strategy at baseline across the full sample (simulated dataset, N = 120)

Overall, these simulated results are consistent with the broader literature suggesting that both mindfulness-based and CBT-based interventions produce substantial anxiety reduction relative to no-treatment control among university students, and offer a plausible, though here only illustrative, pattern of differential temporal dynamics between the two modalities. The absence of a statistically significant head-to-head difference at the final timepoint, despite a numerically favorable trend for CBT, underscores the importance of adequately powered direct comparative trials rather than relying solely on indirect comparisons across separately published single-arm studies.

Conclusion

This training article modeled a three-arm comparative trial examining mindfulness-based and CBT-based interventions for generalized anxiety symptoms among university students. Within the simulated framework, both active interventions produced substantially greater anxiety reduction than waitlist control, with the CBT-based program showing a numerically, though not statistically significantly, steeper late-stage decline relative to the mindfulness-based program.

Implications: If corroborated with empirically collected data, these findings would support university counseling services offering either modality as a credible, scalable first-line group intervention for elevated anxiety symptoms, while suggesting that program duration and timing of outcome assessment may meaningfully influence which intervention appears more favorable in shorter-term evaluations.

Limitations: The principal limitation of this article is that all numerical results are simulated for training purposes and do not derive from an actual clinical trial; no claims of empirical treatment efficacy should be drawn from the reported values. Additional limitations inherent to the modeled design include reliance on self-report outcome measurement alone, absence of long-term follow-up beyond the 8-week intervention window, and the absence of a moderator analysis directly linking baseline coping style to differential treatment response.

Future scope: A genuine empirical study following this framework should incorporate multi-method outcome assessment (e.g., clinician-rated measures alongside self-report), a post-intervention follow-up period of at least three to six months to assess durability of gains, formal moderator analyses examining baseline coping style and anxiety subtype, and adequately powered statistical comparison directly between active treatment arms rather than relying solely on comparisons against a waitlist control.

Ethical Statement

This article was prepared as a simulated-data training exercise for academic formatting practice and does not represent the findings of an actual research study. All numerical data, including participant scores, group means, and statistical test outputs, were constructed by the author(s) to be internally consistent and psychometrically plausible, and are explicitly labeled as simulated throughout the manuscript in accordance with academic integrity standards. No real human participants were recruited, surveyed, or

enrolled in any intervention to generate this content, and no genuine clinical or institutional review board approval was sought or implied. No fabricated real-world author identities, institutional affiliations, or published datasets are presented; author and institutional fields are placeholders to be completed by the end user prior to any submission. This article must not be submitted to any journal as a report of original empirical research unless the simulated data sections are replaced in their entirety with genuine, ethically collected research data obtained with appropriate institutional ethical approval and informed participant consent.

References

1. Auerbach RP, Mortier P, Bruffaerts R, et al. WHO World Mental Health Surveys International College Student Project: Prevalence and distribution of mental disorders. *Journal of Abnormal Psychology*,2018;127(7):623–638.
2. Pascoe MC, Hetrick SE, Parker AG. The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth*,2020;25(1):104–112.
3. Bruffaerts R, Mortier P, Kiekens G, et al. Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*,2018;225:97–103.
4. Hofmann SG, Gomez AF. Mindfulness-based interventions for anxiety and depression. *Psychiatric Clinics of North America*,2017;40(4):739–749.
5. Beck AT. *Cognitive Therapy and the Emotional Disorders*. International Universities Press, 1976.
6. Kabat-Zinn J. *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*. Delacorte Press, 1990.
7. Hofmann SG, Asnaani A, Vonk IJ, Sawyer AT, Fang A. The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*,2012;36(5):427–440.
8. Khoury B, Lecomte T, Fortin G, et al. Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review*,2013;33(6):763–771.
9. Goldberg SB, Tucker RP, Greene PA, et al. Mindfulness-based interventions for psychiatric disorders: A systematic review and meta-analysis. *Clinical Psychology Review*,2018;59:52–60.
10. Querstret D, Morison L, Dickinson S, Cropley M, John M. Mindfulness-based stress reduction and mindfulness-based cognitive therapy for psychological health and well-being in nonclinical samples: A systematic review and meta-analysis. *International Journal of Stress Management*,2020;27(4):394–411.
11. Conley CS, Durlak JA, Kirsch AC. A meta-analysis of universal mental health prevention programs for higher education students. *Prevention Science*,2015;16(4):487–507.
12. Beck JS. *Cognitive Behavior Therapy: Basics and Beyond*. 2nd ed. Guilford Press, 2011.
13. Clark DA, Beck AT. *Cognitive Therapy of Anxiety Disorders: Science and Practice*. Guilford Press, 2010.
14. Hayes SC, Luoma JB, Bond FW, Masuda A, Lillis J. *Acceptance and commitment therapy: Model, processes and outcomes*. *Behaviour Research and Therapy*,2006;44(1):1–25.

15. Segal ZV, Williams JMG, Teasdale JD. Mindfulness-Based Cognitive Therapy for Depression. Guilford Press, 2002.
16. Bishop SR, Lau M, Shapiro S, et al. Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 2004;11(3):230–241.
17. Regehr C, Glancy D, Pitts A. Interventions to reduce stress in university students: A review and meta-analysis. *Journal of Affective Disorders*, 2013;148(1):1–11.
18. Dawson AF, Brown WW, Anderson J, et al. Mindfulness-based interventions for university students: A systematic review and meta-analysis of randomised controlled trials. *Applied Psychology: Health and Well-Being*, 2020;12(2):384–410.
19. Vibe M, Bjørndal A, Fattah S, Dyrdal GM, Halland E, Tanner-Smith EE. Mindfulness-based stress reduction (MBSR) for improving health, quality of life, and social functioning in adults. *Campbell Systematic Reviews*, 2017;13(1):1–264.
20. Spinhoven P, Drost J, de Rooij M, van Hemert AM, Penninx BW. A longitudinal study of mediation of cognitive and mindfulness-based therapy for depression. *Behaviour Research and Therapy*, 2014;56:35–42.
21. Galante J, Dufour G, Vainre M, et al. A mindfulness-based intervention to increase resilience to stress in university students: A randomised controlled trial. *The Lancet Public Health*, 2018;3(2):e72–e81.
22. Carver CS, Connor-Smith J. Personality and coping. *Annual Review of Psychology*, 2010;61:679–704.
23. Skinner EA, Edge K, Altman J, Sherwood H. Searching for the structure of coping: A review and critique of category systems for classifying ways of coping. *Psychological Bulletin*, 2003;129(2):216–269.