Meditation Lowers Stress and Supports Forgiveness Among College Students: A Randomized Controlled Trial

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Abstract. **Objective** and **Participants**: The authors evaluated the effects on stress, rumination, forgiveness, and hope of two 8-week, 90-min/wk training programs for college undergraduates in meditation-based stress-management tools. **Methods**: After a pretest, the authors randomly allocated college undergraduates to training in mindfulness-based stress reduction (MBSR; $n = 15$), Easwaran's Eight-Point Program (EPP; $n = 14$), or wait-list control ($n = 15$). The authors gathered pretest, posttest, and 8-week follow-up data on self-report outcome measures. **Results**: The authors observed no post-treatment differences between MBSR and EPP or between posttest and 8-week follow-up ($p > .10$). Compared with controls, treated participants ($n = 29$) demonstrated significant benefits for stress ($p < .05$, Cohen's $d = –.45$) and forgiveness ($p < .05$, $d = .34$) and marginal benefits for rumination ($p < .10$, $d = –.34$). **Conclusions**: Evidence suggests that meditation-based stress-management practices reduce stress and enhance forgiveness among college undergraduates. Such programs merit further study as potential health-promotion tools for college populations.

Keywords: college health, community health, health education, mental health, stress

Stress is a major issue for college students as they cope with a variety of academic, social, and personal challenges.[1] Most first-year undergraduates are living apart from their parents for the first time. More advanced undergraduates face continuing pressure for academic performance as well as difficult career choices and job search issues. In annual surveys conducted between 1985 and 1995, increasing proportions of students reported feeling overwhelmed.[2] In 2004, stress was the most commonly identified impediment to academic performance, cited by one-third (32%) of nearly 50,000 students surveyed at 74 US campuses.[3] Continuing stress may lead students into unproductive rumination[4] that consumes energy and compounds the experience of stress. Intensified stress can undermine resilience factors,[5] such as hope[6] and the capacity to forgive[7] the many perceived or real interpersonal transgressions that may beset college undergraduates. Although a certain level of stress may result in improved performance, too much stress can adversely affect physical and mental health.[8–10] An important developmental task for college students is learning to manage excess or unnecessary distress while actively engaging with healthy, age-appropriate challenges that promote growth.[5] In this study, we evaluated the effectiveness of meditation-based intervention for reducing distress and enhancing well-being among college undergraduate populations.

Mechanisms through which elevated distress may lead to a range of physical disease outcomes are now well-accepted.[10] In general populations, evidence links psychosocial stressors to conditions ranging from cardiovascular disease and exacerbation of autoimmune diseases to more rapid progression of HIV and accelerated physiological aging at the cellular level.[9,11] Among college students, high levels of distress have been linked with multiple adverse outcomes, including anxiety and depression,[12] suicidal ideation and hopelessness,[13] poor health behaviors,[14,15] increases in headaches,[16] sleep disturbances,[17] increased rates of athletic injury,[18] and the common cold.[19]

Given these findings, effective approaches to managing stress in college undergraduates are needed. Proactively

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addressing stress is consistent with influential college health-promotion paradigms.[20] Coping with stress has been identified as a high-priority issue in the *Healthy Campus* initiatives of the American College Health Association.[21(p8)] In this study, we used a prospective randomized controlled design to evaluate the effects of 2 variants of an 8-week training in stress management. Participants were a self-selected group of primarily first-year undergraduates. We taught each intervention group participant an integrated stress-management and well-being promotion program, based on daily meditation. We presented meditation as fostering not only relaxation but also overall personal growth. We also taught participants ancillary practices for integrating meditative or mindful states of mind into daily activities. From the perspective of stress and coping theory, these ancillary practices involve learning strategies for appraising and coping with stressors.[22] We hypothesized that integrated programs possessing these qualities would measurably reduce stress and enhance well-being.

Institutions of higher education have long been interested in stress-management interventions.[23] Although college administrators are increasingly implementing programs that address student stress, relatively few researchers have rigorously evaluated the effectiveness of such programs. We found only 8 studies of college student stress-management interventions in which researchers used randomized controlled designs.[24–31] Most of these investigators focused on specialized groups, such as nursing, education, or medical students. In one study of nursing baccalaureate undergraduates (N = 40), Heaman[25] observed reductions in state anxiety from a 5-week training in relaxation and biofeedback. Researchers in 3 studies evaluated interventions that combined training in relaxation with cognitive behavioral techniques. In the largest of these studies, which focused on a diverse student group that included graduates and undergraduates (N = 90), Deckro et al[24] observed reductions in psychological distress and anxiety from a 6-week training program. In a second study, focused on nursing baccalaureate undergraduates (N = 76), Johansson[26] showed reductions in anxiety and depression from a 6-week training program. In a third study, focused on introductory psychology students (N = 36), Fontana et al[27] observed reductions in heart rate and state anxiety from a peer-led intervention.

We found 4 randomized stress-management studies in which researchers examined meditation-based interventions for college students.[28–31] Shapiro et al[28] observed decreases in distress and anxiety among premedical and medical students (N = 73) from 7- or 8-session programs based on mindfulness meditation.[32] Astin[29] noted the same among upper-division undergraduates enrolled in a behavioral medicine class (N = 19). Among graduate students in a teacher credential program (N = 21), Winzelberg and Luskin[30] observed decreases in psychological distress after a 4-session training in a program based on *passage meditation*,[33] the practice of meditating on a poem or other inspiring text. Among undergraduates (N = 75), Tloczynski and Tantriella[31] noted decreases in anxiety and depression after 1 session of training in Zen breath meditation.

Findings on college students' stress reduction from meditation are consistent with numerous studies of the physiological and psychological effects of diverse meditation-based interventions in adult populations.[34] Meditation may lead to neurological changes[35,36] and foster physiologic health benefits through improved immune function[37] or reduced arousal as measured by blood pressure, heart rate, cortisol, and many other neurochemical markers.[38] An expert panel of the National Institutes of Health recently found persuasive evidence for better patient outcomes associated with meditation.[39] More generally, meditative practices have been linked with a wide range of positive outcomes related to effective functioning, including academic performance, concentration, perceptual sensitivity, reaction time, memory, self-control, empathy, and self-esteem.[34]

Compared with other stress-management interventions, meditative practices elicit widespread historical and contemporary public interest. In 2002, 7.1% of the US adult population reported using meditation as a medical therapy in the previous year, a higher proportion than that reporting the use of progressive muscle relaxation (3.0%), guided imagery (2.1%), or biofeedback (0.1%).[40] Meditation is also popular because it is perceived as beneficial for spiritual growth and personal effectiveness.[41] Historically, every major faith tradition has transmitted at least 1 method of meditation (sometimes in the form of contemplative prayer).[42] In a national survey of more than 100,000 US college students, a large majority reported an interest in spirituality (80%) or a search for meaning or purpose in life (76%). About half (47%) considered seeking out opportunities to grow spiritually as essential or very important.[43] Like physical exercise that is both aerobic and enjoyable, stress-management exercises—according to the psychological principle of goal alignment[44]—may be more enduringly integrated into many students' lifestyles if they are experienced as not only good for health but also supportive of spiritual growth.

In the present study, we focused on 2 distinct meditation-based integrated programs: an adaptation of Kabat-Zinn's[32] mindfulness-based stress reduction (MBSR) and an adaptation of Easwaran's[33] Eight-Point Program (EPP). We hypothesized that these 2 programs would produce similar changes to each other on the outcomes reported here. Although differing in details, the pedagogy and skills taught in these 2 programs have numerous key similarities (see Table 1). In particular, both programs include a practice of sitting meditation.[42] They also teach nonsitting or informal skills for effectively regulating attention at work or in other situations throughout the day (eg, mindful or focused attention). Both programs encourage cultivating attitudes that support meditative or mindful attention (eg, patience or slowing down), and both offer motivational support by exposing participants to inspiring poetry or readings that reflect meditative or mindful perspectives.[45]

The many similarities in design and intent of the MBSR and EPP programs suggest they are 2 strong examples of meditation management of stress (MMS).

TABLE 1. Summary of Practices and Pedagogy for Meditation Management of Stress (MMS) Interventions

Characteristic	MMS programmatic version[a]	
	MBSR[b]	EPP[c]
MMS practice[a]		
Meditation (sitting)	Mindfulness meditation	Passage meditation
Daily practices (nonsitting or informal)	Mindful attention, recalling the mind to the breath, etc.	Focused attention, recalling the mind to a cue word, etc.
Attitudinal support	Patience, letting go, etc.	Slowing down, detachment, etc.
Motivational support	Poetry reflecting mindfulness perspectives	Readings reflecting meditative perspectives
Program pedagogy[d]		
Instructional setting	Group	Group
Instructional period	8 weekly meetings of 90 min	8 weekly meetings of 90 min
Instructor	Personally uses and models skills	Personally uses and models skills
Long-term support (encouraged)	Meet regularly with group of others doing similar practices	Meet regularly with group of others doing similar practices

Note. MBSR = mindfulness-based stress reduction; EPP = 8-point program.
[a]MMS is defined as stress-management programs that teach a form of sitting meditation as a primary skill, and also teach corollary elements including (1) nonsitting practices that can be used throughout the day to recover or maintain meditative/calm states of mind, (2) cultivation of attitudes or character strengths that support meditative states of mind, and (3) drawing motivation through literature or other people who exemplify or actively seek meditative or calm states of mind.
[b]For details of MBSR practices, see Kabat-Zinn.[32]
[c]For details of EPP practices, see Easwaran.[33]
[d]Represents the pedagogy implemented in the present study and that recommended or most commonly used in previous studies.

Each program teaches a version of sitting meditation as a central skill, but each also offers corollary practices and supports for maintaining meditation and for integrating meditative states of mind into daily living. In our definition, a stress-management intervention is an example of MMS to the degree that it systematically includes each of these elements in its implementation (see definition in Table 1).

Previous research on college students[28–30] as well as adults[46,47] supports the effectiveness of each programmatic example of MMS for reducing stress outcomes. Furthermore, both MBSR and EPP, although commonly perceived as supporting spiritual growth, are nonsectarian and can be practiced within any major religious faith tradition or outside all traditions. Both programs have generated wide international and multicultural interest, and each has had basic program materials translated into more than 15 languages.[48] Both have been successfully taught in multiple healthcare and academic settings, as well as integrated into the daily living of many adults of diverse ages over long periods of time.

Our purpose was to examine the impact of MMS interventions on college students' stress and well-being outcomes. Because we regarded MBSR and EPP as strong examples of MMS programs, we hypothesized no differences—and, in fact, found no statistically significant differences—between the effects of the 2 programs on any of the outcomes presently under study. To obtain greater statistical power, we therefore focus on comparing the effects of receiving either MMS training (MBSR or EPP) against outcomes from a control group.

METHODS

Recruitment, Randomization, and Schedule of Assessments

Participants were undergraduates enrolled at a Roman Catholic university in California. We directed recruitment efforts at first- and second-year students, most of whom lived in on-campus housing; however, third-year students were also eligible. After obtaining approval from the institution review boards of the overall administering organization and the university, we conducted recruitment through flyers, e-mails, classroom presentations, and special recruitment sessions in fall 2004. Approximately 80 students attended 2 recruitment sessions that were held in on-campus housing. We notified approximately 220 additional students through 6 presentations in psychology department classrooms. We also posted flyers in residential facilities, academic buildings, the library, student union, gymnasium, and other on-campus locations visited by an estimated 750 to 1,000 undergraduates. Beyond recruitment sessions and classroom presentations, approximately 75 eligible students expressed interest by directly contacting the recruitment manager, who answered questions and disseminated consent forms. We received 54 completed consent forms. In early January, we e-mailed these 54 participants instructions for the online pretest, which 47 completed. Using computer software, we randomly allocated these 47 participants into the MBSR (n = 16) and EPP (n = 16) training groups and a wait-list control group (n = 15).

Prior to the first group meetings, we allowed some students to change between the 2 MMS intervention groups because of scheduling conflicts. Three students changed from the EPP

group (scheduled at 3:30 PM) to the MBSR group (scheduled at 5:30 PM), and we allowed 2 participants the reverse change from the MBSR to the EPP group. Because of the death of a parent, one EPP participant dropped out after attending 1 session. Two MBSR participants never attended any meetings (one reporting no reason, the other deciding he had overextended himself). Twenty-nine participants completed either the MBSR (n = 15) or EPP (n = 14) version of MMS training. Of these 29 participants, 83% attended all (n = 11) or all but one (n = 13) of the 8 training meetings, 3 missed 2 meetings, and one each missed 3 or 4 meetings (because of sickness).

Eight weeks later, after the conclusion of MMS training, we e-mailed participants in the treatment (n = 29) and control groups (n = 15) a link for the online posttest assessment (Exam 2). All but 1 of the 44 participants (98%) completed Exam 2. After 8 more weeks, we e-mailed a link for the online follow-up assessment (Exam 3), which all but one of the 44 participants (98%) completed. We mailed participants checks of $10 after completing the pretest, $20 after the posttest, and $30 after the follow-up assessment.

Participants

The 44 final participants included in the intent-to-treat analysis ranged in age from 18 to 24 years; they were primarily aged 18 years (59%), first-year (66%), female (80%), white (73%), and Roman Catholic (49%) or had no religious affiliation (42%). Table 2 displays selected participant characteristics. Neither the treatment nor dropout condition was significantly associated with covariables or pretest values of any of the 4 outcome variables (p > .10).

Intervention

The MMS group trainings took place in 8 weekly meetings of 90 minutes each. Each training involved instruction in a form of sitting meditation, informal corollary practices, and cultivation of attitudinal and motivational supports (see Table 1). Each group's weekly meeting included practicing formal sitting meditation, informal discussion, and didactics. MBSR instruction corresponded closely to the MBSR training that has been taught in numerous other settings.[32] EPP training consisted primarily of training in core EPP practices, such as passage meditation, focused attention, and slowing down.[33,48]

Measures

Outcome Measures

We measured 4 major stress and well-being outcome variables at each of the 3 examinations (pretest, posttest, and 8 week follow-up); we measured perceived stress with a 10-item version of the Perceived Stress Scale.[49,50] Scale items aim to tap experiences of distress related to "how unpredictable, uncontrollable, and overloaded respondents find their lives."[50(pp33,34)] Example items include "In the last month, how often have you felt that you were unable to control the important things in your life?" and "...felt difficulties were piling up so high that you could not overcome them?" Validity is demonstrated by observed correlation with measures including stressful life events, social anxiety, depression, self-reported health, symptoms, and health services use.[49,50] Summary scores show adequate reliability (α = .78) and range from 0 (*low stress*) to 40 (*high stress*).

We measured rumination with a 12-item subscale of the Rumination and Reflection Questionnaire (α = .90).[4] Validity is supported by correlations with measures of self-consciousness, neuroticism, depression, anxiety, negative affect, and negative autobiographical memories.[4,51] Example items include "I don't waste time rethinking things that are over and done with" (reversed) and "Sometimes it is hard for me to shut off thoughts about myself," with answers coded on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Scores range from 12 (*low rumination*) to 60 (*high rumination*).

We measured forgiveness of others with a 6-item subscale of the Heartland Forgiveness Scale (test–retest rs and αs > .70 in student samples).[52] Example items include "I continue to be hard on others who have hurt me" (reversed) and "When someone disappoints me, I can eventually move past it," with responses coded on a 7-point scale ranging from 1 (*almost always false of me*) to 7 (*almost always true of me*). Subscale scores possess adequate reliability and range from 6 (*low forgiveness*) to 42 (*high forgiveness*). Validity is supported by correlations with other measures of forgiveness and with trust, cognitive flexibility, fewer hostile thoughts, and various other constructs.[52]

We measured hope with the psychometrically well-supported 12-item Adult Dispositional Hope Scale, designed for respondents aged 15 and older (αs > .74–84 in undergraduates).[6] Validity is supported by correlations with optimism, expectancy for attaining goals, self-esteem, and other constructs. Example items include "There are lots of ways around any problem" and "My past experiences have prepared me well for my future," with responses coded on an 8-point scale from 1 (*definitely false*) to 8 (*definitely true*). Four distractor items do not contribute to the total scores, which range from 8 (*low hope*) to 64 (*high hope*).

Covariables

At Exam 1, we gathered standard measures of age, sex, ethnicity, years in school, and field of study. We also obtained measures of participants' spiritual background and interests. Participants indicated whether they practiced an organized religion and, if so, which denomination. They also answered "To what extent do you consider yourself a spiritual person?" with responses coded on a 4-point scale ranging from 1 (*not at all*) to 4 (*very*).[53(p88)] Participants' *spiritual identities* were assessed with "Which of the following statements comes closest to describing your beliefs: religious and spiritual; spiritual but not religious; religious but not spiritual; neither religious nor spiritual?" Pretest meditation was assessed by the question, "How frequently do you do the following: practice concentrated prayer or meditation for 10 minutes, if necessary by repeatedly bringing my mind back to my intended focus" (with response

TABLE 2. Selected Participant Characteristics, by Treatment Condition

	Group						
	Combined		Treatment		Control		
Characteristic	*n*	%	*n*	%	*n*	%	*p*[a]
Year in school							.32
1st	29	66	21	72	8	53	
2nd or higher	15	34	8	28	7	47	
Sex							.13
Female	35	80	21	72	14	93	
Male	9	20	8	28	1	7	
Ethnicity							.17
White	32	73	19	66	13	87	
Nonwhite[b]	12	27	10	34	2	13	
Major field of study							.29
Social science	17	39	9	31	8	53	
Business/marketing	12	27	8	28	4	27	
Other	15	34	12	41	3	20	
Spiritual identity							.32
Spiritual and religious	11	25	5	17	6	40	
Spiritual, not religious	22	50	17	59	5	33	
Religious, not spiritual	5	11	3	10	2	13	
Neither	6	14	4	14	2	13	
Religious denomination							.59
Roman Catholic	21	48	12	41	9	60	
Other[c]	5	11	4	14	1	7	
None	18	41	13	45	5	33	
Extent spiritual							.92
Very	10	23	6	21	4	27	
Moderate	16	36	11	38	5	33	
Slightly/not at all	18	41	12	41	6	40	
Meditating at pretest							.73
Ever[d]	14	32	10	34	4	27	
Never	30	68	19	66	11	73	
Total	44		29		15		

[a]Fisher exact test (2-tailed).
[b]Included Asian ($n = 5$), Hispanic ($n = 5$), mixed descent ($n = 1$), and nonresponse ($n = 1$).
[c]Included Buddhist, Episcopalean, United Church of Christ, and Mormon/individual path, and nonresponse (each $n = 1$).
[d]One participant reported meditating several times per week at pretest, and all others indicated 3 times per month or less.

categories *never*, *less than once a month*, *1 to 3 times a month*, *once a week*, *several times a week*, and *every day*). Last, a short (13-item) version of the Marlowe-Crowne scale[54] assessed participants' tendencies toward socially desirable responding.

Hypotheses and Statistical Analyses

Our primary hypothesis, which we based on previous findings,[29,30,46,47] was that after training, (1) levels of perceived stress would decline in the treatment groups compared with the control group. We also investigated 3 secondary hypotheses concerning changes after training in the treatment group compared with the control group. We hypothesized (2a) reductions in rumination, (2b) increases in forgiveness, and (2c) increases in hope. A final hypothesis in view of our limited sample size was that (3) no statistically significant differences would emerge between the MBSR and EPP versions of MMS training.

We analyzed effects of treatment on the 4 outcome variables in 4 hierarchical linear regression models.[55] Hierarchical linear models (HLMs) are increasingly a tool of choice for analyzing longitudinal data and are sometimes known, especially among physical scientists, as linear mixed models.[56] Compared with more conventional methods, such as an analysis of variance, an HLM allows improved handling of unbalanced designs and missing data and more flexible analyses of data gathered at multiple timepoints. In HLM terminology,[55] we used the following model in our final regressions:

$$Y_{k(i),t} = c_0 + \beta I_{k,t} + R_{k(i)} + G_k + T_t + e_{k(i),t}.$$

In this formula, $Y_{k(i),t}$ represents the outcome for the i^{th} individual within the k^{th} treatment condition (k = 1 or 2) at Exam t (t = 1, 2 or 3). The treatment effect (in this time-constant treatment effect model) is represented by β, which is the coefficient of $I_{k,t}$, a Level 1 predictor that is 1 for the treatment group at Exams 2 and 3, and 0 otherwise. Thus, $I_{k,t}$ represents whether an individual at time t has received the treatment, but the magnitude of benefit (β) does not vary between time points. The other terms in the model represent adjustments and an error term. Adjustment for preexisting individual differences in outcome level is included as a Level 2 random effect, represented by $R_{k(i)}$. Adjustment for group assignment (eg, baseline group differences, despite their lack of statistical significance) is included as a Level 2 fixed effect, represented by G_k. Adjustment for temporal trends that affect all participants equally is included as a Level 1 fixed effect, represented by T_t. Residual error, the discrepancy between the observed and expected outcome of individual k(i) at Exam t, is represented by the Level 2 random effect $e_{k(i),t}$, assumed to be independent and normally distributed with mean of zero and a variance of σ^2. The global intercept is represented by c_0.

To explore whether the treatment effect might change or decay over time, initial regression models permitted the treatment effect to vary between Exams 2 and 3 (time-varying treatment effect model). These time-varying models replaced $\beta I_{k,t}$ in the earlier formula with $\beta_2 I^{(2)}_k + \beta_3 I^{(3)}_k$, where β_t is treatment effect at Exam t, and each $I^{(t)}_k$ (for t = 2 or 3) is a Level 2 predictor variable equal to 1 at Exam t for treatment group participants, and 0 otherwise. Shapiro-Wilks tests confirmed that, consistent with previous psychometric research, Exam 1 values of each outcome variable did not significantly depart from a Gaussian (normal) distribution. We implemented all regression analyses using SAS PROC MIXED.[56]

RESULTS

Table 3 presents estimates and confidence intervals for changes since pretest on outcome measures. We observed no adverse effects from training. Alpha reliabilities for outcome measures were comparable with findings from previous studies. As noted earlier, we observed no significant differences between the effects from EPP and MBSR at either posttest or follow-up alone, or in time-constant analyses of posttest and follow-up together ($p > .10$). Hypothesis 3 was thus supported. We therefore focus on reporting analyses that aggregated EPP and MBSR into 1 overall MMS treatment condition ($n = 29$).

In Table 3, rows labeled "Exams 2–3" present regression estimates and confidence intervals that model treatment effects as constant in Exams 2 and 3 (the time-constant treatment effect model). These represent usable summary estimates of treatment effects because tests for heterogeneity of treatment effect across time (between Exams 2 and 3) failed for all outcomes to reject the null hypothesis of a time-constant treatment effect (all ps > .10).

Compared with the control group, participants receiving treatment demonstrated significantly larger decreases in perceived stress ($p < .05$, Cohen's[57] $d = –.45$ pretest *SD*s). At posttest, these changes were nearly 40% of a pretest standard deviation in size but were only marginally statistically significant ($d = –.39$, $p = .0995$). By 8-week follow-up, the treatment group advantage had grown to more than half of a pretest standard deviation and attained statistical significance ($d = –.51$, $p = .047$). Taking into account data at both posttest and follow-up, time-constant treatment effect analyses estimated the overall effect of receiving treatment as a statistically significant reduction of 2.78 scale points, equivalent to 45% of a pretest standard deviation. These findings support Hypothesis 1.

Also in time-constant treatment effect analyses, participants demonstrated significantly larger increases in forgiveness ($p < .05$, $d = .34$), thereby supporting Hypothesis 2b. We observed marginally larger reductions in rumination ($p < .10$, $d = –.34$), offering limited support for Hypothesis 2a. Changes in hope were nonsignificant ($p > .10$), failing to support Hypothesis 2c. We present unstandardized treatment effects from time-constant models and for each exam in Table 2. Figure 1 displays changes over time separately for the treatment and control groups; it also displays estimates of the magnitude of the treatment effect that are standardized by the pretest standard deviation of each outcome.

For all outcomes, treatment group changes between pretest and later exams were uncorrelated with socially desirable responding at either Exam 2 or 3—nor, in time-constant models, were treatment effects significantly moderated by socially desirable responding or by any measure of spirituality, religion, or previous experience of meditation (all ps >.10).

COMMENT

Our findings support the primary hypothesis that training college undergraduates in integrated meditation programs can reduce their levels of perceived stress. We observed modest but clinically worthwhile perceived stress reductions of about a half standard deviation, and this persisted at 2-month follow-up. We found mixed support for our secondary hypothesis of salutary changes in other measures of stress and well-being. We found no significant differences between the MBSR and EPP variants of MMS training, which supports our third hypothesis. This pattern of findings provides additional support for offering meditation-based programs, similar to MBSR and EPP, to college undergraduates.

Our findings of reductions in perceived stress are consistent with findings from previous studies of meditation programs in adult populations.[46,47] The perceived stress reductions observed here of –2.78 units (–2.41 at posttest, –3.14 at follow-up) are numerically similar to reductions obtained by Deckro et al,[24] who used this measure among college students in the only randomized study we could find. They used the original 14-item version of the scale[49] and obtained a reduction of 3.54 units, which would correspond to a reduction of approximately $(3.54/14) \times 10 = 2.53$ units on the 10-item version[50] that we used.

TABLE 3. Observed Treatment Effects at Posttest and Follow-up (*N* = 44)

	Exam 1			Treatment effects at Exams 2 and 3				
					Tx change – Cx change			Hypothesized change
Variable	*M*	*SD*	α[a]	Exam	*M*	95% CI (1-sided)	*p*[b]	direction
Perceived stress	18.11	6.19	.86	2	–2.41	–∞ to 0.68	.099	–
				3	–3.14	–∞ to –0.05	.047	
				2,3	–2.78	–∞ to –0.12	.04	
Rumination	43.30	10.16	.94	2	–3.68	–∞ to 1.23	.11	–
				3	–3.15	–∞ to 1.68	.14	
				2,3	–3.41	–∞ to –0.77	.09	
Forgiveness of others	27.60	6.23	.81	2	1.36	–0.95 to ∞	.16	+
				3	2.81	0.54 to ∞	.02	
				2,3	2.11	0.13 to ∞	.04	
Hope	49.84	6.96	.86	2	–1.27	–4.79 to ∞	.27	+
				3	–0.33	–3.80 to ∞	.44	
				2,3	–0.78	–3.78 to ∞	.33	

Note. Exam 1 is pretest, Exam 2 is posttest, and Exam 3 is 8-week follow-up. Tx = treatment group; Cx = control group.
[a]Internal reliability (Cronbach alpha; *N* = 44 for perceived stress, 43 for others).
[b]*T* tests for group differences in mean change from hierarchical linear models (1-tailed).

Our study appears to be one of the first to investigate the impacts of an intervention on either forgiveness or rumination in college populations. Findings of increased forgiveness and reduced rumination are encouraging and suggest that meditation training might foster positive relationships at a time of crucial developmental changes. Because ours was the first study we know of to examine effects of meditation programs or other stress-management interventions on measures of hope, our findings suggest that impacts on hope may not exist or may not be captured by the measure we used. For example, this measure may primarily tap enduring trait-like self-images but be less sensitive for assessing the ongoing state-like experiences that influence these self-images over time.

These findings should be interpreted in view of the positive developmental role that some forms of stress play. People gain resilience not by avoiding all stressful situations but by learning to cope with relevant stressors.[5] Participants experienced relief from perceived distress, but this finding does not directly address long-term program impacts on resilience. Several considerations, however, suggest that these programs favorably affect resilience. As suggested earlier, each program supports growth and refinement in several core coping processes, as understood by coping theory.[22] Participants learn practices for regulating attention throughout the day, such as mindful or focused attention (Table 1, Row 2), that help in managing the time pressures that college students (and many adults in broader society) increasingly experience.[58] Meditative practices also have been linked, as noted earlier, with numerous measures of effective functioning.[34] Participants also learn to draw on attitudinal supports that may influence whether they appraise potentially stressful situations as threatening and stressful or merely inconvenient. Last, participants learn to tap motivational supports relevant to identifying enduring sources of meaning in life. These may assist with major meaning-related developmental challenges, such as career choices, attaining emotional independence from family, and forming enduring personal relationships.[1] Through all these processes, these programs may foster resilience by helping college students form effective repertoires of constructive responses to relevant stressful situations. Without longer empirical follow-up studies, however, positive program effects on resilience remain a conjecture.

Generalizability

Most participants were women, white, and first-year undergraduates, so results may not fully apply to men, nonwhites, and older students. We also cannot be sure if results fully apply to students of Protestant, Jewish, or other religious faiths. More broadly, our results appear most likely to generalize to other populations that are similarly self-selected, not the campus as a whole. Yet as Deckro and colleagues noted about training in stress management, "unless such programs become an integral part of student orientation or are otherwise made compulsory, participants will always be self-selected."[24(p286)]

Limitations

Aside from constraints on generalizability, other limitations include a relatively small sample size and correspondingly reduced statistical power for assessing precise changes over time, or differences in treatment effect that may be associated with covariates. Furthermore, the absence of an active control group treatment, to adjust for generalized benefits of participating in a group, leaves open what specifically accounted for the observed changes. Last, we

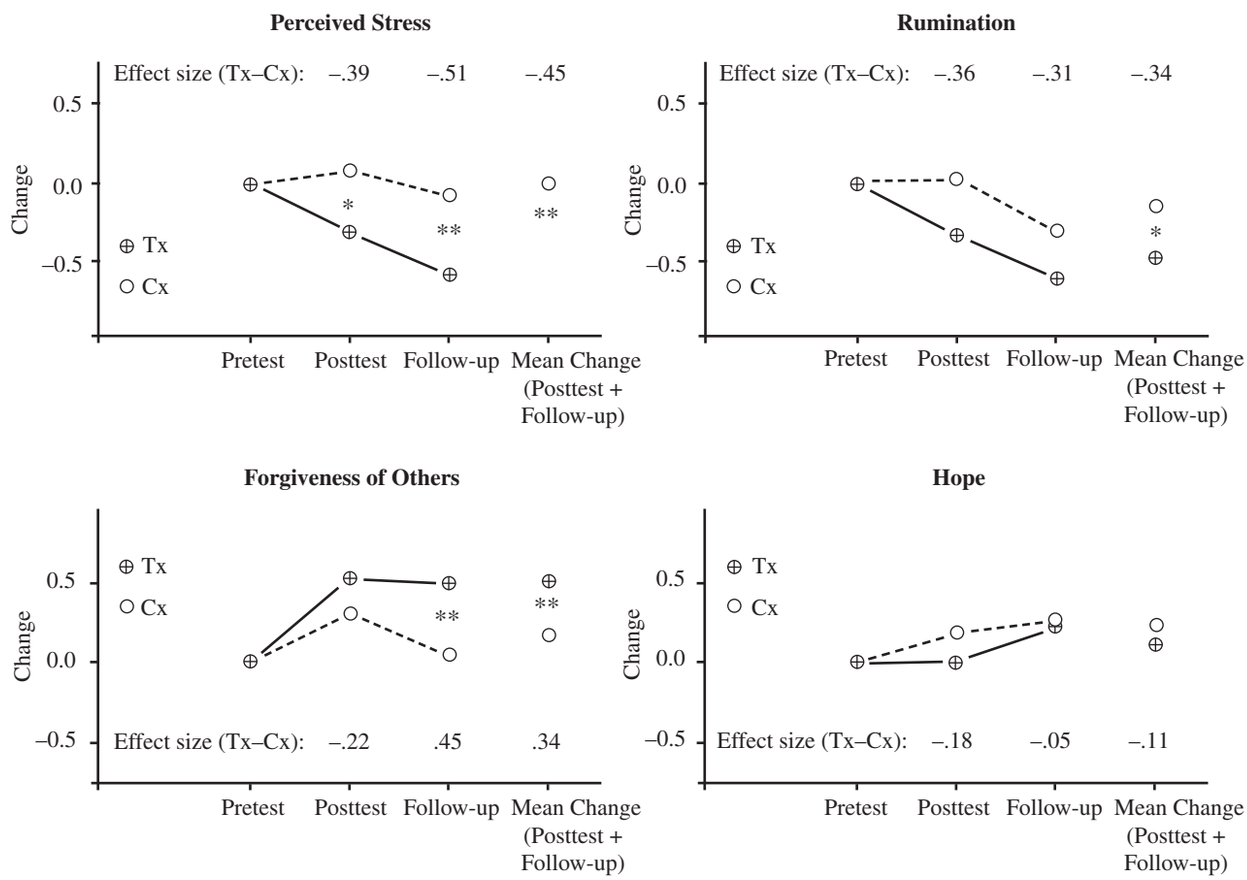

FIGURE 1. Mean changes (presented as pretest standard deviations) from pretest in stress, rumination, forgiveness of others, and hope, for treatment (Tx) and control (Cx) groups ($N = 44$). We standardized effect sizes by pretest standard deviations. $^{*}p < .10$. $^{**}p < .05$, for differences in changes since pretest for treatment ($n = 29$) vs control ($n = 15$) groups (using t tests with hierarchical linear models).

relied entirely on paper-and-pencil self-reports and did not include physiological measures of stress or well-being.

Strengths and Future Directions

Despite these limitations, this study had several strengths. Unlike most other randomized stress-management studies of college students,[24–26,29] our design included a follow-up assessment 2 months after posttest, which revealed that benefits did not significantly diminish after posttest. (Measured benefits for stress and forgiveness actually increased.) Our post-randomization dropout rate of 3/47 (6%), although exceeding the no-dropout apparently attained by several studies,[26,27,30] was substantially better than reported dropout rates of 12% by Heaman,[25] 17% by Tloczynski and Tantriella,[31] 30% by Deckro et al,[24] and 39% by Astin,[29] thereby allowing far less scope for biases from differential attrition.

Our findings are consistent with earlier study results suggesting that meditation programs hold promise as stress-management interventions with college students. Besides testing the generalizability of present results to more diverse undergraduate populations, researchers should evaluate effects on other measures of stress and well-being. One randomized study of undergraduates, for example, documented higher student grades after training in meditation.[59]

Partly because of small sample size, we focused on common features and effects from MBSR and EPP. Future researchers, however, could explore the matching approach used successfully in research on substance-abuse treatment programs, in which different programs were found most effective depending on a client's initial level of a prognostic personal difference variable.[60] For example, demographic or personality variables, such as age, field of study, extraversion, or spiritual or religious orientation, may predict whether optimal long-term results would be obtained by assignment to MBSR, EPP, or a variety of other researched meditation interventions.[45]

We studied meditation programs that have a track record of successful integration into hectic modern lifestyles. Thus, compared with less carefully designed programs, MMS-style integrated meditation programs may offer advantages with regard to long-term stress-management benefits. For example, individuals trained in such programs may continue practicing and receiving positive health benefits for up to 4 years post-intervention.[61] Another important strength

is that the programs we studied are nonsectarian. They appeared to resonate positively with many students' spiritual and religious orientations. More broadly, both MBSR and EPP are compatible with diverse cultural and religious backgrounds: as noted earlier, each has generated international interest, with program materials translated into many languages.[48] Such widespread adult interest suggests that these nonsectarian programs merit study of their capacity to motivate sustained adherence to practices that reduce stress and foster long-term health, well-being, and resilience.

Conclusion

We evaluated the effects of 2 meditation-based programs on undergraduates' stress and well being. These programs have demonstrated stress-reduction effects among adults, are nonsectarian, and generate wide cross-cultural interest. In a self-selected group of undergraduates we documented reductions in stress, increases in forgiveness, and trends toward reduced rumination. Researchers should explore the mechanisms, sustainability, and generalizability of such effects, and how benefits from similar programs can most appropriately and effectively be made available to students.

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NOTE

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