5-1-2015

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Published in final edited form as:
J Am Coll Health. 2014 ; 62(4): 222–233. doi:10.1080/07448481.2014.887571.

A Randomized Controlled Trial of Koru: A Mindfulness Program for College Students and Other Emerging Adults

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Abstract

Objective—To evaluate the effectiveness of Koru, a mindfulness training program for college students and other emerging adults.

Participants—Ninety students (66% female, 62% white, 71% graduate students) participated between Fall 2012 and Spring 2013.

Methods—Randomized controlled trial. We hypothesized that Koru, compared to a wait-list control group, would reduce perceived stress and sleep problems, and increase mindfulness, self-compassion, and gratitude.

Results—As hypothesized, results showed significant Group (Koru, wait-list) X Time (pre, post) interactions for improvements in perceived stress (F=4.50, df [1, 76.40], p=.037, d=.45), sleep problems (F= 4.71, df [1,79.49], p=.033, d=.52), mindfulness (F=26.80, df [1, 79.09], p<.001, d=.95), and self-compassion (F=18.08, df [1, 74.77], p<.001, d=.75). All significant effects were replicated in the wait-list group. Significant correlations were observed among changes in perceived stress, sleep problems, mindfulness, and self-compassion.

Conclusions—Results support the effectiveness of the Koru program for emerging adults in the university setting.

Keywords

college health; emerging adulthood; meditation; mindfulness; stress management

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Conflict of Interest

After completing the current research study, Dr. Rogers co-founded the Koru Center for Mindfulness, of which she has an ownership share; if Koru is found to be an effective intervention, she could benefit financially. Dr. Maytan has received compensation for teaching from the Koru Center for Mindfulness. Dr. Greeson, Mr. Juberg, and Ms. James, who were responsible for collecting and analyzing the data for this study, report no financial relationship relevant to the subject of this article.

According to the 2012 National Survey of College Counseling Centers, 92% of counseling centers are serving increasing numbers of students each year and 88% of directors report a continued trend towards students presenting with increasing levels of psychopathology.[1] Counseling centers are feeling this strain despite evidence that only a small percentage of struggling students seek treatment from university health centers.[2,3] The level of stress amongst students is alarming. About 50% of students report significant levels of anxiety and depression[2,4] and 16.5% report a history of suicidal or self-harm behavior.[2] Moreover, sleep disturbance is prevalent in college students and has been proposed as a transdiagnostic risk factor for poor mental health.[5,6] The effects of mental health problems for students are not insignificant, as students with mental health challenges have difficulties with campus engagement, personal relationships, and graduation rates.[7] Because of the magnitude of the problem and the limitations on available resources, those working in student health and wellness need creative, developmentally targeted, evidenced-based strategies to effectively reduce stress and improve well-being in student populations. Mindfulness-based interventions may play a role in filling this important need.

Mindfulness, the skill of learning to pay attention, without judgment, to one's present–moment experience, offers a way to improve well-being in diverse populations.[8] Mindfulness meditation training has been shown to reduce stress and improve mood and academic performance in both college and graduate students.[9–12] In the U.S., Mindfulness-Based Stress Reduction (MBSR) and variants of MBSR are the most commonly used methods of teaching mindfulness meditation to adults. MBSR was developed by Jon Kabat-Zinn[13] and is effective for improving psychological health, with meta-analyses documenting medium-to-large effect sizes.[14–15] While there has been work on developing programs specifically for children and teens[16], there has been little discussion about targeting mindfulness training specifically towards other critical developmental stages, such as emerging adulthood.

Emerging adulthood is the developmental stage from the late teens through the twenties, which includes most college students.[17] In 2011, 68.2% of graduating high school students enrolled in post secondary education, and in the fall of 2011 there were nearly 21 million students enrolled in either two or four-year degree granting institutions.[18] College-attending and non-college-attending emerging adults (EAs) have similar developmental characteristics[19], and the overall rate of psychiatric disorders is roughly equivalent between college-attending individuals and their non-college-attending peers.[4] Because the primary emphasis in emerging adulthood is on identity exploration, this life stage is associated with frequent changes and uncertainty in all life spheres.[19]

Mindfulness meditation offers a promising tool for managing the stress that may be associated with the challenges of emerging adulthood. However, there are no objective data about what pedagogical methods may be effective for training Eas in mindfulness. Due to their unique developmental stage, Eas may not engage readily in training programs that are designed for older adults due to time-constraints, skepticism about the potential benefits, and difficulty maintaining motivation to effect behavior change.[20] To address this disparity, Rogers and Maytan[21] have developed Koru, a manualized training program in mindfulness, meditation, and other mind-body skills, that specifically targets emerging adults.

Koru is the New Zealand Maori word for the unfurling fern frond, which symbolizes balanced growth. Koru differs from mindfulness programs developed for more general populations of adults in several key ways. First, the program trains Eas in certain mind-body skills, such as abdominal breathing and guided imagery, as well as insight meditation practice. These mind-body skills, for which studies show a positive effect on stress and anxiety[22–23], give participants tools for quickly reducing distress, which in turn builds their motivation to continue practicing stress management and self-care in daily life. Second, Koru is relatively brief, with only four 75-minute sessions and 10 minutes of required daily meditation practice. The course is highly structured and attendance at all four classes is required. Third, the program is taught in a small group format to capitalize on peer interactions that Eas value. Fourth, the teaching is very active, addressing skepticism and building motivation quickly. Finally, the language and metaphors used are designed to resonate with the interests and concerns of Eas. In addition to teaching mindfulness skills to cope with stress, Koru also emphasizes cultivating positive emotions like self-compassion and gratitude. Both compassion and gratitude are considered core qualities of mindfulness[24], and have been associated with lower levels of stress and psychological symptoms and greater well-being in prior studies.[25,26] Koru has been very popular with students and those who have participated report positive outcomes on course evaluations.[20,21] However, until now, Koru has not been subjected to rigorous quantitative evaluation.

The present randomized controlled trial (RCT), therefore, aimed to evaluate the effectiveness of Koru for emerging adults in a university setting. We hypothesized that college and graduate students who participate in Koru, when compared to a control group, would show reduced stress, improved sleep, and increased mindfulness, self-compassion, and gratitude.

Methods

Study Design

The RCT had two study arms: (1) Koru, the active intervention, and (2) a Wait-list control. We chose to use a wait-list control condition to control for the effects of time, because levels of stress, sleep problems, and even self-concept can change during an academic semester. Students who were randomly assigned to the wait-list control group were offered an opportunity to participate in Koru later the same semester. We felt that this design struck a balance between scientific rigor, by benefitting from an experimental design with random assignment to groups, with the use of a culturally normal wait-list process for the Koru program, which should optimize motivation and retention.

Following online informed consent, study participants completed standardized self-report questionnaires via a survey website within 1-week before and after participating in the 4-week Koru program. The study protocol was conducted between Fall 2012 and Spring 2013. Full approval by the university's Institutional Review Board was obtained prior to data collection.

Students were eligible for the study if they were: (a) currently enrolled as an undergraduate, graduate or professional student, (b) at least 18 years of age, (c) proficient in English, (d)

able to use a computer with internet access, and (e) willing to be randomized to either the Koru group or the Wait-list control group. Blocked randomization (block size = 2) was used to ensure balanced study groups after every two students enrolled. The randomization schedule was created using Research Randomizer (www.randomizer.org), and was performed by the study coordinator who kept group assignments blinded from other study staff who performed statistical analyses. Following randomization, the study coordinator contacted students to inform them of their group assignment. Subsequently, the Koru instructors contacted students enrolled in Koru with an introductory email and a request to begin reading the required text, *Wherever You Go, There You Are (*Kabat-Zinn, 1993). To protect against social desirability bias and potential evaluation bias, Koru course instructors were not directly involved in subject recruitment, consent, randomization, or data collection procedures.

Power analyses (G*Power Version 3.1.5, Kiel, Germany) based on a difference between two independent means (two groups) at a significance level of .05, a desired power of .80, and a medium-to-large effect size (i.e., Cohen's d = .6) based on prior meta-analyses, indicated that 45 students per group would be required to detect a significant difference for the Koru versus wait-list control group.[27]

Participants

Participants were 90 undergraduate, graduate, and professional students (M age = 25.4, SD = 5.7; Range = 18–59). Two graduate students, one who was 59 years old and another who was 42, provided baseline survey data but dropped out before attending the Koru group to which they were randomly assigned. The oldest student who provided complete pre and post survey data was 31 years old. Seventy-four students provided data on the post-MBSR survey, a response rate of 82%.

As shown in Table 1, the sample comprised mostly women (66%) who were predominantly white (62%) and non-Hispanic (85%). Half of students reported having no religious affiliation or being atheist. Nearly three-quarters were in graduate or professional school. The two randomized study groups did not differ on any demographic characteristics, except average hours of sleep per night. The Koru group reported sleeping half an hour less per night, which was statistically significant but still within the normal range of healthy sleep. We defined program completion as attending at least three of the four Koru classes. There were no significant differences at baseline between students who completed Koru versus those who did not. The only outcome variable that differed significantly was the isolation subscale of the Self-Compassion Scale; the group of students that completed the Koru program reported a mean decrease in their sense of isolation, whereas the group that attended two or less Koru classes reported a mean increase in their sense of isolation post-intervention.

Procedure

The secure, online survey was administered using Qualitrics software (Provo, UT) and included basic demographic information and a battery of standardized self-report questionnaires. The questionnaires assessed symptoms of stress, sleep problems,

mindfulness of thoughts and feelings, self-compassion, and gratitude. Participants were not offered financial compensation for completing the surveys.

Intervention

As detailed in a recently published treatment manual[21], the Koru program is offered at a large university through Counseling and Psychological Services and consists of four required 75- minute classes. The classes include 12–14 students taught by 1 or 2 teachers. Students typically participate in Koru because they are seeking training in mindfulness and meditation to help reduce stress and enhance psychological well-being. The Koru program is free of charge, and voluntary, is not graded, and students do not receive course credit for participating. In addition to attending all four weekly small-group sessions, the Koru program requires a commitment to practicing meditation for at least 10 minutes daily, completing and returning a daily meditation log, as well as reading the required chapters in the course book, *Wherever You Go, There You Are* (Kabat-Zinn, 1995). The meditation log includes space for daily documentation of two things for which the student feels grateful. During each class, students learn and practice mindfulness meditation and one or two mind-body skills, including breathing exercises, walking meditation, guided imagery, and eating meditation.

Measures

Perceived Stress Scale (PSS)—The 10-item PSS measures perceived stress over the past month, defined by the degree to which one feels like life has been unpredictable, uncontrollable, or overwhelming. The PSS scores have demonstrated reliability and construct validity in student samples and emerging adults.[28] Cronbach's α was .83 for PSS scores at both time points.[29]

Medical Outcome Study Sleep Scale (MOS SLP9)—The sleep scale is one subscale of the Medical Outcomes Study (MOS) health status measure.[30] It consists of 12 items to measure 6 sleep dimensions: initiation (time to fall asleep), quantity (hours of sleep each night), maintenance, respiratory problems, perceived adequacy of sleep, and somnolence (daytime sleepiness). The time frame for the responses is "the past 4 weeks." The 9-item summary scale (Sleep Problems Index II) was used for analysis.[30] Higher scores indicate greater sleep problems. Cronbach's α was .88 for sleep quality scores at both time points.[29]

Cognitive and Affective Mindfulness Scale-Revised (CAMS-R)—The 12-item CAMS-R was used to measure four aspects of trait mindfulness, including attention, awareness, acceptance, and present-focus. Previous psychometric evaluation of the CAMS-R found scores to be reliable and valid[31], and a recent outcome study found that the CAMS-R was sensitive to change following Mindfulness-Based Stress Reduction training.[32] Cronbach's α for CAMS-R scores was .88 at baseline and .80 post-intervention.[29]

Self-Compassion Scale (SCS)—The 26-item SCS[33] was used to assess participants' tendency to treat themselves with kindness and understanding rather than harsh judgment and criticism during difficult times, to perceive difficult experience as part of common humanity, and to consider difficult thoughts and experiences as separate from the core self.

The SCS has six subscales (Self-Judgment, Self-Kindness, Isolation, Common Humanity, Mindfulness, Over-identification) that can be summed to attain a total score. SCS scores have been shown to be reliable and valid in previous studies of college students.[33] The SCS was also sensitive to change with a Mindful Self-Compassion training program.[34] Higher scores on all scales indicate higher levels of self-compassion. Cronbach's α for SCS total scores was .94 at baseline and .95 post-intervention.[29]

Gratitude Questionnaire (GQ-6)—Dispositional gratitude was measured using the GQ-6[35], which has demonstrated good convergent validity with relevant constructs such as positive affect and prosocial traits.[36] Cronbach's α for GQ-6 scores was .88 both pre- and post-intervention.[29]

Other Measures—Demographic characteristics were assessed at the end of the online survey, and are reported in Table 1.

Data Analysis

All statistics were performed using IBM SPSS version 20 (Armonk, NY). Variables were screened for distributional assumptions prior to analysis. All continuous outcome variables approximated a normal distribution with skewness and kurtosis less than 2.0. Primary analyses of between-group effects were tested using linear mixed-effects models, which provide several statistical advantages over traditional repeated measures ANOVA.[37] Group assignment was treated as a fixed effect and outcome variables were treated as random effects that could vary within-person and across time. This analytic strategy, based on restricted maximum likelihood estimation (REML), allowed all subjects to be included in the models, even those with missing data. Therefore, mixed-effects models were consistent with Intent-to-Treat (ITT) principles without requiring imputation, such as last observation carried forward (LOCF), which can bias parameter estimates. Mixed-effects modeling also provided the advantage of accounting for dependence of observations in a repeated measures design, a phenomenon that frequently violates an assumption of traditional ANOVA using the general linear model.

The primary hypothesis of a significant difference between-groups over time was tested using a Group x Time interaction effect, which indicated the effectiveness of Koru compared to a wait-list control. Within the same model runs, t-tests were used to test hypotheses about planned contrasts between pre and post intervention scores within the Koru and control groups, and to test for differences between-groups at baseline and at the post-intervention time point. Effect sizes for between-group differences over time were calculated using Cohen's *d* and *eta*-squared.[38] Secondary analyses included within-group mixed-effects models to replicate the effects of Koru among wait-listed students who took the program later in the same semester. Secondary analyses also included correlations among changes in outcomes measures as a function of randomized group assignment. Consistent with recommendations for clinical trials, statistical significance for all parameter estimates was set at $z = 1.96$, $\alpha = .05$, two-tailed.[39]

Results

Baseline Characteristics and Preliminary Analyses

Baseline levels of perceived stress fell more than one standard deviation above the norm for adults between ages 18–34 and for adults with an advanced degree.[28] Baseline sleep problems fell nearly one standard deviation above the general population norm.[30] Mindfulness scores fell approximately one standard deviation below a published norm for college students[31], and was comparable to a sample of adults who participated in an 8-week, self-pay Mindfulness-Based Stress Reduction (MBSR) program.[32] Self-compassion fell nearly one standard deviation below the college student norm[33] and the mean gratitude score was comparable with the mean reported by scale developers for college students.[35] T-tests revealed no significant differences between groups on primary outcome variables at baseline, except gratitude which was significantly higher in the Koru group (see Table 2). One subscale of the Self-Compassion Scale (Common Humanity) was higher in the Koru group at baseline. Data were relatively normally distributed with all z-scores for skewness and kurtosis less than 2.0.

Figure 1 provides a flow diagram for recruitment and retention throughout the trial. Overall, 90% of students who enrolled in the study completed the baseline survey and were randomized. Over 82% of randomized students were retained. Of the 45 students initially randomized to Koru, 33% attended all four classes, 38% attended three or more classes, 18% attended two classes, and 4% attended only one class. Seven percent (n=3) did not attend any Koru classes after they were initially assigned to the group. Of the 45 students who participated in Koru after being randomized to the Wait-list group, 33% attended all four classes, 27% attended three or more classes, 11% attended two classes, and 2% attended only one class. Twenty-seven percent of students (n=12) initially assigned to the Wait-list did not attend any Koru classes when they were offered the opportunity later in the semester. Consistent with Intent-to-Treat (ITT), all students who were randomized were analyzed. No adverse events were reported by any participant during the study.

Primary Analyses

As hypothesized, there was a significant group X time interaction for change in perceived stress scores (see Table 2). Whereas perceived stress scores for the control group did not change over time ($t = 0.71$, $p = .48$), perceived stress decreased significantly in the Koru group ($t = 3.62$, $p = .001$). A medium effect size on perceived stress was observed for Koru compared to the Waitlist control (Table 2), as evidenced by a half-standard deviation larger reduction in perceived stress scores ($d=.45$), with 5% of the variance in perceived stress scores over time explained as a function of group assignment ($eta^2 = .048$).

There was also a significant group X time interaction for change in sleep problems (see Table 2). Whereas sleep quality scores for the control group did not change over time ($t = 0.03$, $p = .98$), overall sleep quality improved significantly in the Koru group ($t = 3.04$, $p = .003$). A medium effect size on sleep problems was observed for Koru compared to the Waitlist control (Table 2), as evidenced by a half-standard deviation larger reduction in

sleep quality scores (d=.52), with 6% of the variance in sleep quality scores over time explained as a function of group assignment (eta^2 = .063).

A significant group X time interaction was observed for change in mindfulness scores (see Table 2). Whereas mindfulness scores for the control group did not change over time (t = 0.59, p = .56), mindfulness increased significantly in the Koru group (t = −6.60, p < .001). A large effect size on mindfulness of thoughts and feelings was observed for Koru compared to the Waitlist control (Table 2), as evidenced by a one-standard deviation larger increase in CAMS-R mindfulness scores (d=-.95), with 18% of the variance in mindfulness scores over time explained as a function of group assignment (eta^2 = .184).

A significant group X time interaction was also observed for change in self-compassion scores (see Table 2). Whereas self-compassion total scores for the control group did not change over time (t = −0.20, p = .84), they improved significantly in the Koru group (t = −6.38, p < .001). A large effect size on total self-compassion scores was observed for Koru compared to the Waitlist control (Table 2), as evidenced by a three-quarter standard deviation larger increase in total self-compassion scores (d=−.75), with 12% of the variance in total self-compassion scores over time explained as a function of group assignment (eta^2 = .123).

To examine the sources of change in overall levels of self-compassion, we ran separate mixed-effects models on each of the self-compassion subscales (see Table 2). Whereas the Wait-list Control group only reported a significant pre-post change on one subscale, Common Humanity, the Koru group reported significant pre-post changes on all six subscales: increased Self-Kindness, Common Humanity, and Mindfulness, and decreased Self-Judgment, Isolation, and Over-identification (see Table 2). Effect sizes for Self-Compassion Scale subscales fell in the medium range for Self-Kindness and Mindfulness, and in the large range for Self-Judgment, Isolation, and Over-identification. The Common Humanity subscale, which improved significantly for both groups, showed a small effect size in favor of Koru (see Table 2).

The group X time interaction for change in gratitude was not statistically significant. Neither group reported a significant pre-post change in gratitude (see Table 2).

Secondary Analyses

Mixed-effects models on students originally assigned to the wait-list (n=45) who took Koru later in the semester replicated all significant effects observed among students who were randomized to take Koru first. Within-subjects analyses modeled change over three time points: baseline, post wait-list, and post-Koru. Significant effects of time (all p-values <. 005) were accounted for by significant changes from time 2 to time 3 for the following variables: perceived stress scale (t = 3.56, p=.001); sleep problems (t = 12.75, p<.001); mindfulness (t = 5.08, p<.001); self-compassion total (t = 6.24, p<.001); self-judgment (t = 4.37, p<.001); isolation (t = 4.70, p<.001); over-identification (t = 4.10, p<.001); self-kindness (t = 3.68, p<.001); and mindfulness (t = 4.14, p<.001). Consistent with students randomized to take Koru first, students randomized to take Koru later in the semester had large effects sizes (within-subjects Cohen's d = t/√n) for changes in mindfulness (d=.76) and

total self-compassion scores (d=.93), and medium effect sizes for perceived stress (d=.53) and most self-compassion subscales (d=.55 to .70). The effect size for improvement in sleep problems was substantially larger (d=1.90), and the effect on an increased sense of common humanity was marginally significant (t = 1.96, p=.054) with a small effect size (d=.29).

As expected, numerous significant correlations were observed between changes in perceived stress, sleep problems, mindfulness, and self-compassion among students originally randomized to Koru (see Table 3). Notably, changes in mindfulness, self-compassion total scores, self-judgment, and over-identification were significantly correlated with all other outcome variables (except gratitude) in the Koru group. In contrast, compared to students randomly assigned to Koru, students assigned to the wait-list group reported fewer than half as many significant correlations (see Table 3). These findings are consistent with the hypothesis that improvements in stress, sleep, mindfulness, and compassion are interrelated during Koru.

Comment

Emerging adulthood, the transitional stage between high school and adulthood, has been defined as a distinct developmental stage with unique needs and challenges.[17,19] This age group struggles with concerning levels of stress-related psychological conditions including anxiety[40], depression[2], and sleep disturbance.[5] Mindfulness-based interventions have proved effective for reducing stress in university students.[41] The main results from this RCT found that Koru, a new mindfulness training program designed specifically for emerging adults, produced significant improvements in perceived stress, sleep quality, mindfulness, and self-compassion in a university student cohort of emerging adults. Gratitude was not measurably affected. Koru was well liked by students as reflected by high enrollment and retention in the study.

The results of this trial replicate and extend previous studies of meditation and mindfulness training for university students. For example, the significant effect on lowering perceived stress was similar in magnitude to a published RCT on college students that compared the effect of two meditation programs to a wait-list control group.[9] Lower perceived stress following participation in Koru is also consistent with another wait-list controlled trial with medical students.[10] Other RCTs that found significant reductions in perceived stress and psychological distress included a 6-week mind-body program based on the relaxation response and cognitive-behavioral therapy skills[42] and a 3-arm trial that compared five sessions of mindfulness meditation training, somatic relaxation training, and a wait-list control.[43] Thus, the significant stress reducing effect of Koru in this study was comparable to other, often longer, stress management and skill building programs for students.

Koru also produced a significant decrease in sleep problems, an effect that has previously been limited to uncontrolled studies.[44] Whereas RCTs of MBSR and Mindfulness-Based Cognitive Therapy (MBCT) have recently documented improvements in objective measures of sleep quality among adult populations with insomnia[45] and depression[46], the present study adds to the literature by demonstrating that improvements in subjective sleep quality

among university students is directly correlated with increased levels of mindfulness and self-compassion.

Consistent with a recent meta-analysis of over 12,000 participants in mindfulness-based therapies, Koru produced clinically significant effect sizes on multiple measures of psychological well-being.[14] The largest effect sizes in this study were seen for increases in mindfulness and self-compassion. The increase in mindfulness with Koru was comparable to increases in mindfulness seen with an 8-week MBSR program[32], an 8-week Mindfulness Based Cognitive Therapy (MBCT) program[47], and an 8-week Mindful Self Compassion (MSC) program.[34] Although Koru's relatively large effect size for self-compassion (d=.75) was substantially less than that for MSC (d=1.67), it had somewhat stronger effects on mindfulness and stress. This difference may reflect that Koru does not specifically target self-compassion, but rather mindful attention, awareness, relaxation, and self-regulation. Nevertheless, changes in self-compassion in this study were comparable to those seen in other primary mindfulness interventions such as MBSR.[48] Given the association between higher levels of self-compassion and better psychological well-being[25,34], this study suggests that Koru may promote student health, in part, by helping emerging adults develop a healthier way of relating to themselves in difficult times – a way marked by greater self-kindness and less self-judgment; a greater sense of connection through common humanity and less isolation; and better emotional balance through greater mindfulness and less over-identification with one's problems.

Secondary findings demonstrated that all of the significant effects observed in a group of students randomized to receive Koru could be replicated in wait-listed students later in the same semester. Moreover, correlations among improvements in perceived stress, sleep problems, mindfulness, and self-compassion were predominantly significant in the Koru group. This finding indicates that Koru-related benefits in mental and behavioral health are interdependent. Taken together, the significant changes in perceived stress, sleep, mindfulness and self–compassion with Koru suggest that tailoring mindfulness training to emerging adulthood by incorporating other mind-body skills, using fewer class sessions, requiring shorter but mandatory home practice, and contextualizing mindfulness training to reflect common interests and concerns of Eas is an effective strategy.

The relative brevity of the training model may contribute to the high retention rates and thus effectiveness of Koru. Students identify time pressures as one of the primary reasons for not seeking help for mental health concerns.[3] Thus, Koru was designed to be as efficient as possible. Koru involves 5 hours of class time over 4 weeks, plus the expectation of 10 minutes of practice/day. In comparison, MBSR involves 27 hours of class time over 8 weeks, plus the expectation of 45 minutes/day of meditation practice.[49] The decreased time requirement of Koru appears to work well for young adults who are juggling competing pressures. The present study demonstrates that significant results can be achieved within a relatively short, 4-week time frame. Others have found benefits with brief exposure to mindfulness training. For example, one 5-session training model that included a daylong meditation retreat found significant decreases in psychological distress and rumination, and significant increases in positive mood, among undergraduate and graduate students reporting distress.[43] Another recent study found reductions in anxiety and associated neural correlates

with only four 20-minute mindfulness trainings.[50] The relatively high retention rate of 82% in our study may reflect the appeal of Koru for emerging adults.

Strengths and Limitations

The strengths of the study included a randomized experimental design, adequate statistical power provided by a relatively large sample size, inclusion of all available data from all randomized subjects, and relatively high levels of program adherence and survey completion. Limitations included reliance on self-report surveys for primary outcome measures, which are susceptible to recall bias; limited diversity in the student sample, which precludes broader generalizability; and use of pre- and post-intervention measures, which limits understanding of when beneficial effects started to occur and how long beneficial effects might last after Koru training. Future research can build on the present study by using an objective measure of mindfulness, such as monitoring breaths or heart beat while practicing meditation[51], enrolling a more diverse group of students, and including both interim and follow-up assessments to better describe the process and durability of change following Koru.

Conclusion

College students make up a substantial fraction of the emerging adult demographic.[18] A large proportion of college students report significant stress-related mental health concerns, including anxiety and depression.[41] These types of mental health concerns impact students both interpersonally and academically.[7] Mindfulness-based interventions are known to provide significant improvement in anxiety, depression and stress reactivity in adults and university student populations.[41,52] Only a small percentage of struggling students receive treatment from university health centers[2,3], therefore it is critical that a broader range of mental-health outreach services be provided for students. The results of this study show that Koru, a relatively brief, developmentally targeted mindfulness program, was effective at reducing symptoms of stress, enhancing psychological well-being, and promoting sleep – a key health behavior – for emerging adults who are students in a university setting. These findings support Koru as a viable intervention for student counseling centers and other agencies that seek to provide cost-effective, low-stigma interventions for students suffering from unmanageable levels of stress. Further research is needed to explore the effectiveness of Koru in other emerging adult populations in community colleges, historically black colleges and universities, and non-academic settings.

Acknowledgments

We thank the staff at Duke Counseling and Psychological Services including the director of outreach services Gary Glass, PhD, and the administrative assistant for outreach services, Mary Cicinnati. We also thank all of the undergraduate, graduate, and professional students who volunteered their valuable time to participate in the trial and complete our survey. Finally, we thank Karen Caldwell, PhD, for assistance with SPSS code for the mixed-effects models, and Dennis Carmody, BA, for technical assistance with randomization procedures and database management.

Funding

This manuscript was supported by grant R00 AT004945 from the National Center for Complementary & Alternative Medicine (NCCAM) to JMG. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the National Institutes of Health (NIH).

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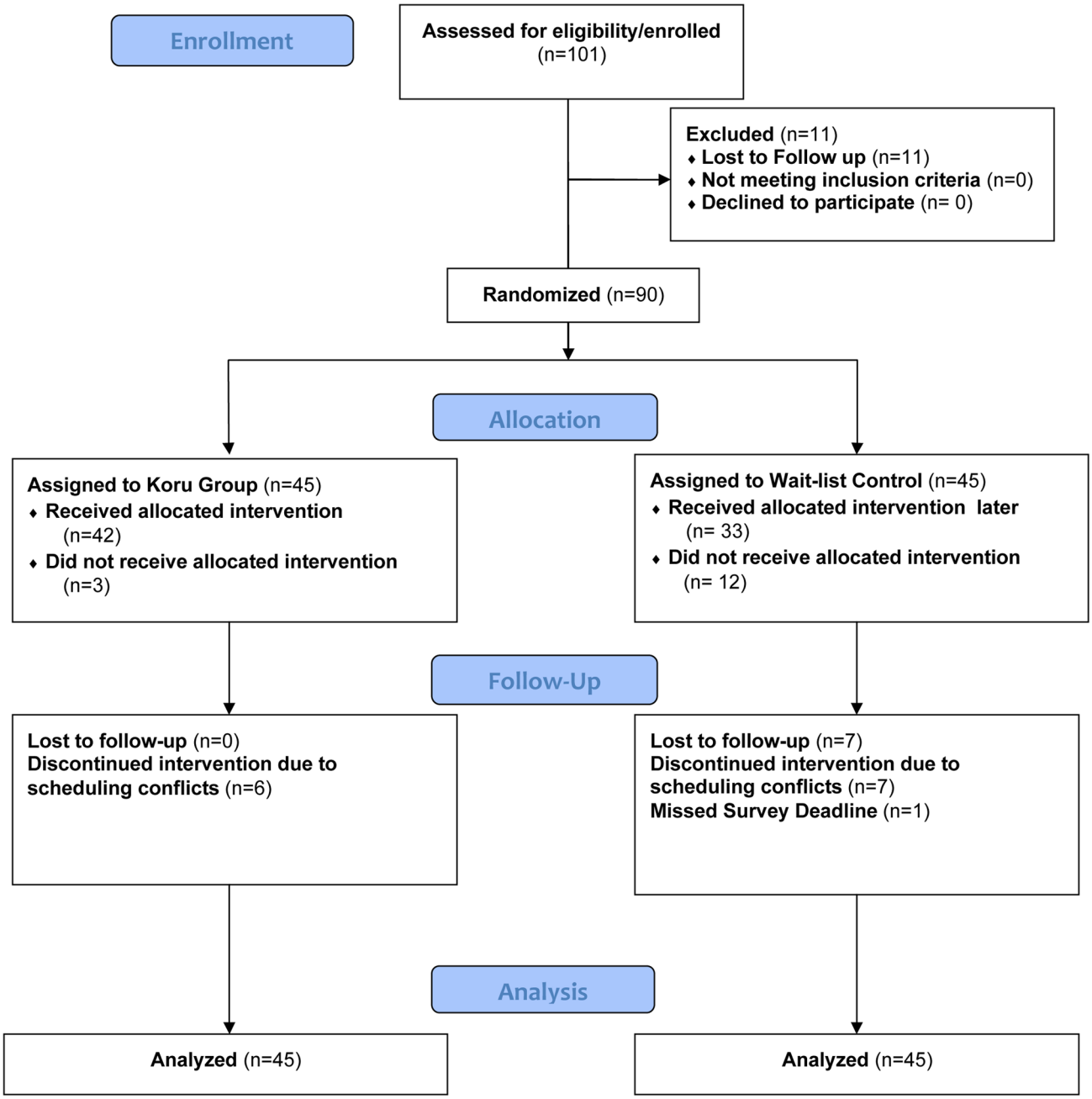

Figure 1.
CONSORT flowchart of participants retained at each phase of the trial.

Table 1

Baseline characteristics of study participants.

Characteristic	Koru Group n=45	Wait-list Group n=45	Difference Statistic
Age [mean years (SD)]	25.75 (6.84)	24.76 (4.15)	t(84)=0.81, p=.423
Gender			$\chi^2(1)=0.05$, p=.842
Male	15	16	
Female	30	29	
Ethnicity			see note
Hispanic	4	1	
Non-Hispanic	38	38	
Prefer not to Answer	3	5	
Race			$\chi^2(1)=0.79$, p=.375
White	30	26	
African-American	3	2	
Asian American	10	13	
Other	1	3	
Prefer not to Answer	1	1	
Religion			$\chi^2(2)=2.14$, p=.343
No Religious Affiliation	14	19	
Atheist	5	7	
Buddhist	1	0	
Christian	13	7	
Jewish	1	2	
Hindu	2	1	
Muslim	0	2	
Unitarian/Universalist	1	1	
Other	2	1	
Prefer not to Answer	6	5	
Education			$\chi^2(2)=0.32$, p=.852
Undergraduate 1st yr	0	3	
Undergraduate 2nd yr	6	2	
Undergraduate 3rd yr	4	3	
Undergraduate 4th yr	2	5	
Undergraduate 5th yr	0	1	
Graduate Student	20	20	
Professional Student	13	11	
Sleep [mean hrs per night (SD)]	7.56 (1.09)	8.09 (1.16)	t(88)=2.26, p=.027

Characteristic	Koru Group n=45	Wait-list Group n=45	Difference Statistic
Sleep medication (n; % yes)	8 (18%)	6 (13%)	$\chi^2(1)=0.34$, p=.561

Note: Chi-square could not be computed for Ethnicity due to less than five Hispanic students per group.

Other demographic categories with less than five students each were collapsed as follows.

Race: white, racial minority. Religion: no religious affiliation, atheist, religious affiliation.

Education: undergraduate, graduate, professional student.

Table 2

Changes in outcome variables for Koru and Waitlist control groups.

Outcome	Koru Group		Waitlist Control		Mixed Model ANOVA (Group X Time)			
	Pre	Post	Pre	Post	F	p	d	eta^2
Perceived Stress	23.71 (5.65)	20.43* (6.20)	25.66 (5.65)	25.04 (5.96)	76.40	0.04	0.45	0.048
Sleep Problems	41.36 (16.21)	32.52* (18.06)	42.91 (16.21)	42.84 (17.23)	79.49	0.03	0.52	0.063
Mindfulness	28.69 (5.63)	33.77* (6.06)	27.22 (5.63)	26.79 (5.87)	79.09	0.00	−0.95	0.184
Self-Compassion (total)	2.73 (0.66)	3.25* (0.70)	2.61 (0.66)	2.62 (0.68)	20.07	0.00	−0.75	0.123
Self-Kindness	2.64 (0.77)	3.20* (0.84)	2.47 (0.77)	2.55 (0.80)	9.20	0.00	−0.06	0.083
Common Humanity	2.79 (0.84)	3.14* (0.90)	2.41 (0.84)	2.65† (0.87)	0.51	0.48	−0.13	0.004
Mindfulness	3.07 (0.76)	3.46* (0.82)	2.86 (0.76)	2.85 (0.80)	8.03	0.01	−0.51	0.061
Self-Judgment	2.67 (0.79)	3.28* (0.87)	2.74 (0.79)	2.64 (0.83)	15.39	0.00	−0.86	0.156
Isolation	2.54 (0.88)	3.16* (0.95)	2.55 (0.88)	2.46 (0.91)	17.56	0.00	−0.79	0.135
Over-identification	2.68 (0.85)	3.30* (0.91)	2.61 (0.85)	2.60 (0.88)	16.81	0.00	−0.72	0.115
Gratitude	35.93 (6.96)	36.32 (7.51)	32.58 (6.96)	32.31 (7.26)	0.24	0.62	−0.09	0.002

Note: Pre and post scores from mixed-effects models are shown as estimated marginal means (SD). Statistics are shown for Group X Time effect, which tested for the effectiveness of Koru over time compared to the Waitlist control. Cohen's d = difference between pre-post change in Koru and pre-post change in Waitlist divided by pooled SD. Range: 0.20 = small, 0.50 = medium, 0.80 = large (Cohen, 1988). Eta^2 range for percent variance explained in outcome due to group assignment: 0.01 = small, 0.06 = medium, 0.14 = large (Cohen, 1988). Higher scores for all self-compassion scales indicate higher levels of self-compassion.

*p<.005,

†p<.05 for within-group changes by paired t-test (see text).

Table 3

Correlations among study variables for Koru Group (n=35) below diagonal and Wait-list Control (n=39) above diagonal.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Perceived Stress (PSS)	--	.322*	−.142	.199	−.094	.161	.241	−.275†	−.267	−.243	−.164
2. Sleep Problems (MOS)	.313†	--	.059	−.250	−.238	−.021	−.019	−.138	.013	−.334*	.100
3. Mindfulness (CAMS)	−.611***	−.450**	--	.496**	.454**	.123	.361*	.187	.098	.315†	.057
4. Self-compassion (total)	−.459**	−.405*	.711**	--	.661**	.060	.565**	.731**	.426**	.536**	.239
5. Self-Kindness (SCS)	−.322†	−.335*	.613**	.821**	--	.039	.537**	.253	−.096	.207	−.070
6. Common Humanity (SCS)	−.243	−.309†	.523**	.628**	.416*	--	.191	−.354*	−.145	−.192	−.277†
7. Mindfulness (SCS)	−.255	−.262	.594**	.799**	.657**	.553**	--	.145	−.052	.024	−.025
8. Self-Judgment (SCS)	−.486**	−.334*	.582**	.881**	.642**	.487**	.568**	--	.456**	.459**	.417**
9. Isolation (SCS)	−.388*	−.196	.462**	.642**	.396*	.077	.400*	.563**	--	.048	.266
10. Over-identification (SCS)	−.378*	−.444**	.505**	.825**	.624*	.427*	.593**	.691**	.508**	--	.293†
11. Gratitude (GQ6)	−.203	−.286†	.276	.241	.143	.329†	.118	.222	.174	.117	--

† p<.10

* p<.05

** p<.01