Do Mindfulness Meditation Apps Decrease Stress in College Students?
ABSTRACT

Background: Mindfulness meditation apps have become popular self-help technology tools to manage stress and improve mental health. Mindfulness meditation classes have been associated with decreased stress levels, but the impact of mindfulness meditation apps at reducing stress levels among college students has not been thoroughly examined.

Objectives: The objective of this study was to assess how the frequency and duration of mindfulness meditation app use during a two-week interval affected self-reported stress levels. The study analyzed how minutes and days of app use during a 14-day period impacted change in self-reported stress compared to baseline.

Methods: A longitudinal sample of 85 undergraduate students were recruited to the study through fliers and in-class announcements. Eligibility requirements ensured that participants had no prior or limited (< 2 hours) experience with mindfulness meditation. Pre- and post-assessment survey questions included perceived stress levels and the frequency and duration of meditation app use during the two-week study interval. Multiple linear regression analyses were used to assess whether there was a relationship between app use and change in stress.

Results: The mean Perceived Stress Scale scores at time 1 and time 2 significantly differed ($P < .001; t = 3.47$), such that there was a significant decrease in self-reported stress over the study interval. The number of minutes of mindfulness mobile app use over the 14 days of the study was not predictive of stress change ($P = .14$), but the number of days practicing mindfulness was a significant predictor of stress change ($P = .03$).
**Conclusions:** Consistently practicing mindfulness may be more predictive of stress reduction than length of practice, as evidenced by a significant relationship between change in stress and number of days practicing mindfulness meditation, but not number of minutes practiced.

**KEYWORDS**

Stress; Mindfulness; Meditation; Mobile; Applications; Technology
INTRODUCTION

The American Psychological Association states that stress is “defined as a negative emotional experience accompanied by biochemical, physiological, and behavioral changes” [1]. Over time, stress can increase individual risk for physical and mental health problems including heart disease, depression or anxiety [1]. The transition to adulthood can be a particularly stressful time. In a survey of college students in America, 49% reported feeling more than average stress or tremendous stress in the past 12 months [2]. Mindfulness meditation has been shown to reduce stress and anxiety [3], but there is a gap in the literature in regards to mindfulness in phone app use. Research is lacking surrounding how duration and consistency of meditation app use differentially impact stress levels among college students.

Mindfulness Background

Mindfulness is defined as the practice of being aware of the present moment [4]. In recent years interest and acceptance of the practice has increased [5], leading researchers to question its legitimacy as a health solution. Many studies have documented positive effects of mindfulness-based therapies on mental and physical health [6,7] including improved quality of life [8] and well-being [5,9], and a reduction in psychiatric symptoms [10]. Even short interventions have found that increased mindfulness effectively decreases anxiety and stress [11,12].

Mindfulness Apps

In 2008 the self-help industry generated approximately $12 billion in revenue [13]. This preceded the spread of the smartphone, which is now owned by 94% of Americans ages 18-29 years [14]. These smartphones provide access to over 35,000 health-related apps in the Apple
Store [15] and over 500 apps relating to mindfulness between the Apple Store and Google Apps [16]. In a sample of 525 people, 76% reported being interested in using their mobile phone to improve their mental health [17]. Another study found that 58% of mobile phone users had downloaded a health-related app, and most felt that the apps had improved their health [18].

Despite growing evidence for the positive effects of mobile health applications and face-to-face mindfulness-based training programs, there is still very little research examining the efficacy of mindfulness apps [16]. Chittaro & Vianelle [19] found that among 14 participants who participated in a 5-week study using a mindfulness app, 13 participants reported that practicing mindfulness decentered them from their worries. However, in a 4-week study of 78 pregnant women living in Italy, mindfulness phone app use was not found to significantly affect measures of psychological wellbeing [20].

**Purpose & Aims**

Although the healthcare industry has started to promote mindfulness as a method to reduce stress and prevent mental health issues [21], the usefulness of mobile apps has yet to be thoroughly examined. Since college students experience heightened anxiety [22] and are among the largest group of mobile app users with some estimates indicating that over 99% of college students own a cellphone [23], it is especially important to understand the impact that mindfulness apps have on reducing stress. The purpose of this study was to empirically explore how the minutes and days of mindfulness mobile apps within a two-week study interval impacted self-reported perceived stress levels. Assessing the impact of minutes of app use allows for better understanding of how quantity of timing doing meditation impacts stress levels, while exploring
the impact of days of app use elucidates how consistency of practicing mindfulness meditation affects stress level. The results from the study can be used to inform college students and health care providers alike about the usefulness of mindfulness apps on reducing stress among the vulnerable population.

METHODS

Recruitment and Procedures

The sample consisted of 85 undergraduate students who were recruited through fliers and in-class announcements. To be eligible, participants had to be currently enrolled in classes at the university and have had limited (< 2 hours) or no prior experience with mindfulness meditation. Data came from a larger study that has previously been described (AUTHOR, n.d.). In brief, participants came to two lab visits. During the first visit, participants completed informed consent and were introduced to mindfulness and a free mindfulness meditation app called Smiling Mind. Participants then took a survey which measured perceived stress and demographic information. They were encouraged to practice mindfulness meditation at their own discretion and fill out a log with the number of minutes they practiced each day for two weeks. During the second lab visit, participants handed in their log and completed a follow-up survey about their perceived stress.

Measures

Stress

A self-reported measure of stress was acquired for each participant during the first and second lab visits through their responses to questions on a five-point Likert Scale (ranging from 0 to 4)
using the Perceived Stress Scale [24]. The reliability of the 10-item Perceived Stress Scale has been previously reported with a Cronbach’s alpha between 0.84-0.86 [24]. The Cronbach’s alpha for time 1 in this study was 0.83. At time 2, the Cronbach’s alpha was 0.87. Composite scores for stress at the first and last lab visit were created for each participant by averaging their scores across the 10 items. Higher scores indicated greater stress. A new variable was created to reflect change in perceived stress from the start to the end of the study period by subtracting stress at time 2 from time 1, such that higher scores indicated a greater reduction in stress.

**Mindfulness Meditation Application Use**

Self-reported measures of mindfulness meditation app use included the number of days and total minutes the participant used the app between lab visits in the two-week study period. Each participant recorded their mindfulness app use in a meditation log. Participants were incentivized to complete and return the log at the second lab visit, even if they recorded 0 minutes of mindfulness meditation, by entering them into a drawing for one of two e-gift cards worth $100.

**Statistical Analysis**

SAS analytic software was used to calculate all descriptive and inferential statistics. Descriptive statistical analysis checked for item distributions including means, outliers, and missing data. Linear regression analysis was used to determine how the days and total minutes of mindfulness meditation app use impacted participants’ change in stress.

We examined if participant age, gender, relationship status, and number of hours worked per week were associated with the independent and dependent variables. The demographic variables
were not correlated with the independent variables, as they did not significantly change the parameter estimates. The demographic variables were thus not included in the final linear regression models.

RESULTS

Sample Description

The participants were on average 21.75 years old, 45 participants (52.9%) were female (n=85), 20 participants (23.5%) were married (n = 85), and 68 participants (80%) self-identified as White or Caucasian (n = 85). Over the two-week study period, participants practiced mindfulness an average of 9.3 days and for 64.3 minutes (range: 0-210 minutes; this is an average of a little under 5 minutes per day over a 14-day period). The average decrease in self-reported stress over the 14-day study period was by 0.19 points on the five-point scale. Paired t-test indicated that the mean stress score at time 1 was 1.84 (on a scale of 0-4 points, with higher scores indicating greater stress) on the Perceived Stress Scale, and the mean stress score at time 2 was 1.66 (P < 0.001; t = 3.47).

Multiple Linear Regression

The number of minutes of mindfulness mobile app use was not predictive of stress change (P = .14), but the number of days practicing mindfulness was a significant predictor of stress change. For every one unit change in the number of days that participants used the meditation apps, there was a reduction in stress by 0.03 (SE = 0.01, P = .03) on the self-reported Perceived Stress Scale.

DISCUSSION
**Principal Results**

The results of this study demonstrated that the number of days practicing mindfulness meditation was predictive of a reduction in stress, but the number of minutes practicing mindfulness meditation over a 14-day period was not predictive of change in stress. These results indicate that consistently practicing mindfulness may be more predictive of stress reduction than length of practice in a single session and refutes a quick-fix approach to mindfulness as a stress reducer. Thus, providing new mindfulness meditation app users with support to consistently practice mindfulness mediation over a period of time, even for just a few minutes each day, may be most efficacious at reducing stress. These results might differ in a population with previous experience practicing mindfulness meditation, as the present study was conducted on a sample comprised of college students with limited prior experience with mindfulness meditation. However, other studies have also demonstrated that ongoing, consistent practice is necessary to sustain health and cognitive benefits [8,25].

The changes in stress demonstrated in this study per day of mindfulness meditation were only about one-third of a point on a five-point scale. Although this change may appear to be very small, it occurred over only a 14-day period among app users new to mindfulness. As users become more experienced at engaging in mindfulness and continue to consistently practice mindfulness, greater reductions in stress levels may be seen.

**Strengths and Limitations**

The results should be interpreted in the context of the study limitations. This study included students from a large university in the intermountain west. The population was a convenience...
sample of mostly white undergraduates. Because of the homogenous nature of our sample, the results may not be representative of other young adult groups. Furthermore, we did not utilize a control group in this study, which limits our ability to show a causal relationship between app usage and stress reduction. A randomized control study from a more diverse population would strengthen the utility of the results and the generalizability of the findings.

Despite these limitations, our study expands on the previous body of literature. First, it examined the impact of meditation apps specifically among college students, a population generally very familiar with app usage. Second, it assessed how meditation apps impact stress in particular. Finally, our study distinctly explored how duration and consistency of meditation app use differentially impacted stress levels among college students. Our findings are particularly useful for practitioners who use mindfulness as a suggested self-help tool for stress reduction, and it highlights the need to emphasize consistent practice rather than occasional interventions. Likewise, mindfulness app developers may be able to improve their products by implementing app elements that encourage users to practice mindfulness daily. Follow-up studies should further explore the relationship between app use duration and consistency and how each impacts stress levels among participants.
REFERENCES


