2017

Immediate Effects of the Mindful Body Scan Practice on Risk-Taking Behavior

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IMMEDIATE EFFECTS OF THE MINDFUL BODY SCAN PRACTICE ON RISK-TAKING BEHAVIOR

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Arts

in

The Department of Psychology

by
Shelley Renee Upton
B.S., The University of North Carolina at Chapel Hill, 2012
August 2017

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LIST OF ABBREVIATIONS – in order of their appearance

1. MBSR – mindfulness-based stress reduction
2. MBCT – mindfulness-based cognitive therapy
3. MBRP – mindfulness-based relapse prevention
4. DRM – Deese-Roediger-McDermott
5. PFT – psychological flexibility theory
6. DSM-V – Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition
7. ADHD – attention-deficit/hyperactivity disorder
8. DBT – dialectical behavior therapy
9. MBAT – mindfulness-based addiction treatment
10. BART – Balloon Analogue Risk Task
11. MAAS – Mindful Attention Awareness Scale
12. SMS – State Mindfulness Scale
13. ANOVA – analysis of variance
14. ANCOVA – analysis of covariance

ABSTRACT

The concept of mindfulness stems from Buddhist philosophies. Recently, it has become secularized and used in psychological and medical treatments. Training in mindfulness has been shown to improve a variety of mental disorders (e.g., depression, anxiety), as well as physical conditions (e.g., irritable bowel syndrome, chronic pain). Additionally, mindfulness training has been shown to improve risk-taking behaviors following several weeks of training. Reducing risk-taking behaviors is of particular importance in regards to specific psychological disorders, such as substance use and eating disorders. Many studies that examine the effects of mindfulness utilize training programs that are typically 8-weeks or longer in duration. However, some evidence indicates that brief, single-use mindfulness practices can have substantial effects on changing emotion and cognition in laboratory settings. The present study examined the immediate effects of a single-use mindfulness practice—the mindful body scan—on risk-taking in an experimental laboratory setting. ANOVA analyses indicated that there was no significant interaction of condition and scores on the risk-taking task—suggesting that the mindful body scan audio did not impact risk-taking. Implications and limitations are discussed.

INTRODUCTION

Overview of Mindfulness

Mindfulness is traditionally defined as being aware of each moment as it is happening and observing that moment without judgment (Kabat-Zinn, 1994). This definition will be used for the purposes of this study. Those who practice mindfulness are often instructed to pay attention to the sensations in their body, the emotions they feel, their thoughts, and their interactions with others and the outside world (Nhat Hanh, 2006). Components of a mindfulness practice often include exercises such as yoga, focusing on the breath, body scan meditations, and compassion meditations (Kabat-Zinn, 1990). It is important to note the distinction between mindfulness and mindfulness-based practices and exercises: the exercises are not themselves "mindfulness"—rather, they facilitate the psychological process we call mindfulness. Therapies that incorporate mindfulness-based practices (e.g., Acceptance and Commitment Therapy, Dialectical Behavior Therapy) and programs that are solely focused on developing mindfulness (e.g., mindfulness-based stress reduction, mindfulness-based cognitive therapy) have become increasingly popular in recent years as both treatments for clinical populations and as interventions for nonclinical populations (Ederth & Sedlmeier, 2012; Khoury et al., 2013a).

Mindfulness-based interventions formally entered into psychological research with the advent of mindfulness-based stress reduction (MBSR). MBSR was developed in the late 1970s by Jon Kabat-Zinn, a microbiologist, at the University of Massachusetts (Kabat-Zinn, 1984). MBSR is based upon traditional Buddhist philosophies that have been stripped of their religious overtones and packaged into an 8-week group session format (Kabat-Zinn, 1990). The popularity and effectiveness of the MBSR program as a treatment for persons suffering from chronic or severe medical conditions led to the development of more specialized mindfulness-based

interventions for use as mental health treatments such as mindfulness-based cognitive therapy (MBCT) and mindfulness-based relapse prevention (MBRP; Segal, Williams, & Teasdale, 2002; Bowen, Chawla, Marlatt, 2011). MBCT and MBRP are modeled after MBSR and are delivered in an 8-week group session format.

Effects of Mindfulness-Based Interventions

Research on the effects of mindfulness-based interventions in recent years has been very promising. Mindfulness training has been shown to improve overall wellbeing while reducing anxiety, chronic pain, and depression (Ederth & Sedlmeier, 2012; Khoury et al., 2013a). Mindfulness training has also been shown to have a moderate effect on more severe mental illness, such as psychosis (Khoury, Lecomte, Gaudiano, & Paquin, 2013b). While mindfulness interventions have largely been studied in adult populations, more and more research with child and adolescent populations is emerging. In youth populations, mindfulness interventions and therapies have been developed for a variety of conditions and circumstances (e.g., clinical/nonclinical populations, homeless youth, chronic pain sufferers; Kallapiran, Koo, Kirubakaran, & Hancock, 2015; Ruskin, Kohut, & Stinson, 2014; Viafora, Mathieson, & Unsworth, 2015). Meta-analyses have shown that mindfulness interventions and therapies within youth populations can lead to improved mental health and overall well-being (Kallapiran et al., 2015).

Additionally, mindfulness training in the school setting has been growing in popularity (Zenner, Herrnleben-Kurz, & Walach, 2014). These programs have led to improvements in executive functions, aggression, social problems, resilience, and stress (Flook et al., 2010; Parker, Kupersmidt, Mathis, Scull & Sims, 2014; Zenner et al., 2014). These interventions are either taught by a trained mindfulness teacher who is brought into the school, or by the regular

classroom teacher who has undergone a brief training in mindfulness-based practices (Parker et al., 2014; Viafora et al., 2015). Similar to MBSR and other mindfulness-based interventions with adults, mindfulness-based interventions with youth are also conducted over a series of several weeks and involve a variety of mindfulness-based exercises (e.g., yoga, breathing exercises, and other meditations) along with psychoeducation.

Immediate vs. Cumulative Effects of Practicing Mindfulness

Unlike many psychological treatments, which were built around extant literature, mindfulness-based treatments have mostly been adaptions from MBSR, an already formed treatment package. When MBSR was shown to have desirable outcomes, its format (e.g., group-based weekly sessions) was replicated to create more specialized treatment programs. These adapted treatments demonstrated desirable outcomes (Khoury et al., 2013a); however, these programs have not been subjected to component analyses and are therefore based on several assumptions that have not been empirically validated. These assumptions include that one must practice mindfulness in order to teach it effectively as an intervention and that multiple treatment sessions are necessary—consisting of multiple types of mindfulness-based practices—in order to obtain a therapeutic effect (Kabat-Zinn, 1990; Shonin & Van Gordon, 2015). Nevertheless, research is emerging indicating that clinically significant changes can be detected after a single session of treatment. No formal research has compared the outcomes of mindfulness-based treatments between teachers who practice mindfulness daily, those who do not, and automated treatment delivery technologies, such as audio recordings (Samson & Tanner-Smith, 2015). Additionally, nuanced studies that differentiate the effectiveness of the several mindfulness-based exercises included in each treatment package are rare (e.g., mindful breathing versus loving-kindness meditation; Feldman, Greeson, & Senville, 2010). Examining the immediate

effects of mindfulness-based exercises within a controlled lab setting is thus a worthwhile scientific endeavor, as it will allow researchers to investigate the traditional assumptions of mindfulness-based treatment approaches (i.e., highly-trained interventionist, several sessions, multiple types of practices) for the purposes of developing interventions that are more feasible for both clients and clinicians.

Only a few studies exist that have examined the immediate effects of mindfulness training in an experimental lab setting. One study by Ostafin and Kassman (2012) examined how a single-use mindfulness induction—the mindful body scan practice—may impact individual's ability to solve insight problems (e.g., problems that are not solvable through a series of steps, but rather an "Aha!" moment). They theorized that mindfulness may facilitate cognitive restructuring of the problem (i.e., looking at the problem differently to avoid getting stuck) and thus allow individuals to solve the problems more effectively. Results from this study showed that mindfulness induction in a lab setting led to participants solving more insight problems and that this relationship was mediated by participants' level of state mindfulness (Ostafin & Kassman, 2012). Additionally, Cropley, Ussher, and Charitou (2007) investigated the effects of a single-use lab induction of mindfulness—again, the mindful body scan practice—on participants' urge to smoke. Findings from this study showed that the mindfulness induction immediately reduced participants' urge to smoke in abstinent smokers, compared to a control group. Those in the mindful body scan group also reported decreased irritability, tension, and restlessness (Cropley et al., 2007).

Another study looked at how mindfulness may pose some disadvantages when induced in a lab setting (Wilson, Mickes, Stolarz-Fantino, Evrard, & Fantino, 2015). Participants completed the Deese-Roediger-McDermott (DRM) paradigm, a widely used paradigm that assesses one's

susceptibility to creating false memories. The participants then listened to a mindfulness meditation or mind wandering (control) audio and completed the DRM paradigm again. The researchers found that those in the mindfulness meditation group were more likely to create false memories after listening to the mindfulness induction than those in the control group. A subsequent study showed that those who listened to the mindfulness audio performed significantly worse in a reality monitoring paradigm. The researchers posit that this may be because mindfulness meditations instruct listeners to suspend judgment of thoughts and feelings, thus making it more difficult to discern whether a memory was fabricated or real (Wilson et al., 2015).

Taken together, the above lab-based studies show that single-use mindfulness-based practices can have an immediate effect on cognitive and psychological functioning without participating in a multi-week intervention program (e.g., MBSR, MBCT), without receiving the manipulation from a highly-trained interventionist, and without engaging in multiple types of mindfulness-based practices. Thus violating the three assumptions of traditional mindfulness-based treatments mentioned above. These findings suggest that mindfulness-based exercises could be utilized in a more targeted and feasible fashion, without the need for extensive training or resources. Because programs such as MBSR, MBCT, and MBRP incorporate many different elements and are used for numerous presenting problems, differential effects of the many components of these treatment packages are not well known. Evidence from these brief lab studies suggests, however, that participants with particular presenting problems may need to only practice one mindfulness-based exercise in order to glean the necessary therapeutic benefits.

How Mindfulness Works

The mechanism through which practicing mindfulness achieves these immediate changes may be explained by psychological flexibility theory (PFT). PFT posits six underlying processes that facilitate psychological rigidity, which lead to the development and maintenance of many mental disorders (Fletcher & Hayes, 2005; Hayes, Levin, Plumb-Vilardega, Villate, & Pistorello, 2013). These are cognitive fusion, experiential avoidance, fixating on the past or future, self-conceptualization, lacking contact with values, and inaction toward valued ends. *Cognitive fusion* occurs when an individual views their thoughts and feelings as literal directions for action. An example of this would be when an individual becomes "glued to their thoughts" and acts upon their thoughts and feelings. *Experiential avoidance* occurs when an individual avoids a public event to reduce the likelihood or the severity of a private event. This might happen when an individual avoids the classroom because academic situations make them nervous. Fixating on the past or the future is simply when a person is lacking contact with the present moment. They may be ruminating over something that happened in the past or worrying about something that may happen in the future. *Self-conceptualization* is the idea that an individual is the same as the private events they experience. People may have an idea of themselves and can become upset when their behavior or other's behavior does not match their concept of the self. The final two processes that facilitate psychological rigidity occur when a person lacks contact with their values and does not engage in action that leads them to their values (Fletcher & Hayes, 2005; Hayes et al., 2013).

The opposite of these processes, therefore, facilitates psychological flexibility: the ability to persist or change behavior to achieve valued ends (Fletcher & Hayes, 2005; Hayes et al., 2013). These processes are referred to as defusion, acceptance, the self as context, being present,

contact with values, and committed action. The first four processes are the processes that comprise our understanding of the original definition of mindfulness given to us by Kabat-Zinn (1994), which is noted above as the definition of mindfulness adopted for the purposes of the present study. Contact with values and committed action are not "mindfulness" per se, but they are facilitated by the preceding four processes that make-up mindfulness. Responding to one's thoughts and feelings as possibilities (defusion) and responding to one's thoughts and feelings in an open and receptive way (acceptance) are considered to be the most pivotal therapeutic processes and are the most common targets of mindfulness-based interventions. When one is engaging in a mindfulness-based exercises (e.g., the mindful body scan) and is practicing contacting one's thoughts and feelings in an open and non-judgmental way, then one can be considered to be "being mindful." Thus, practicing mindfulness facilitates desired outcomes because it promotes psychological flexibility (Hayes et al., 2013).

Mindfulness and Risk-Taking Behavior

Although mindfulness and PFT are applicable for understanding the development and maintenance of a variety of psychological and behavioral problems, the particular problem of interest in the present study is risk-taking behavior. Risk-taking is defined by the Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (DSM-V; American Psychiatric Association, 2013) as:

> engagement in dangerous, risky, and potentially self-damaging activities, unnecessarily and without regard to consequences; lack of concern for one's limitations and denial of the reality of personal danger; reckless pursuit of goals regardless of the level of risk involved. Risk-taking is a facet of the broad personality trait domain DISINHIBITION (p. 828).

Risk-taking behaviors are a component of numerous mental disorders outlined in the DSM-V (APA, 2013). These disorders include attention-deficit/hyperactivity disorder (ADHD), bipolar

disorder and related disorders, binge-eating disorder, intermittent explosive disorder, conduct disorder, antisocial personality disorder, borderline personality disorder, and substance-related and addictive disorders.

Risk-taking behaviors have been shown to develop in early childhood, as elementary-school age youth display intentions to use alcohol or other substances (van der Vorst, Schuck, Engels, & Hermans, 2014). Risk-taking behaviors may develop for numerous reasons, and meta-analyses have shown that males are more likely to engage in risk-taking behaviors than females. However, patterns of risk-taking differ across age and context (Byrnes, Miller, & Schafer, 1999). Risk-taking behaviors can lead to a host of deleterious consequences, including patterns of behavior characteristic of the psychological disorders listed above as well as physical injury to self and/or others (Turner, McClure, & Pirozzo, 2004).

Mindfulness may play a role in mediating risk-taking behaviors. Trait mindfulness, which is conceptualized as an individual's general mindful state, has been associated with many numerous well-being behaviors, including reduced risk-taking frequency and severity (Brown & Ryan, 2003; Lakey, Campbell, Brown, & Goodie, 2007). Higher levels of trait mindfulness, for example, may be a protective factor concerning the decision to smoke in adolescence (Black, Sussman, Johnson, & Milam, 2012). In regards to alcohol use, research has shown that trait mindfulness is negatively correlated with drinking behaviors (Reynolds, Keough, & O'Connor, 2015). Lower levels of trait mindfulness (e.g., not acting with awareness, reactivity, being judgmental) are also associated with more severe levels of substance use disorders, such as alcohol use disorder (Levin, Dalrymple, & Zimmerman, 2014).

Beyond correlational research, mindfulness-based exercises have shown utility for reducing risk-taking behaviors. Notably, dialectical behavior therapy (DBT) was developed

specifically to treat disorders characterized by risk-taking (Linehan, 1993). DBT, considered a "third wave" behavior therapy, incorporates mindfulness-based exercises that target suicidal behavior in individuals diagnosed with borderline personality disorder. Meta-analyses that examine the efficacy of DBT have shown that the therapy substantially improves suicidal and self-injurious behaviors (Panos, Jackson, Hasan, & Panos, 2014). Beyond DBT as a general treatment approach, a study by Hendrickson and Rasmussen (2013) demonstrated that a single mindfulness-based practice—mindful eating—can reduce risk-taking behavior in obese individuals, who have a higher propensity for risk-taking. Meta-analyses confirm that other mindfulness-based treatments have moderate to large effects on binge eating behaviors (Godfrey, Gallo, & Afari, 2015). Training in mindfulness has also been shown to improve externalizing behaviors, such as those related to ADHD and conduct disorder, which are often characterized by increased risk-taking (Bogels, Hoogstad, van Dun, de Schutter, & Restifo, 2008). Additionally, newer research investigating mindfulness-based addiction treatment (MBAT) shows that it may be more effective at treating disorders characterized by addiction than traditional cognitive behavior therapy (Vidrine et al., 2016).

The Present Study

Mindfulness-based interventions and therapies have been shown to improve numerous problem behaviors, including reducing risk-taking behavior. However, as stated, research surrounding mindfulness-based interventions began by testing already formed treatment packages. Therefore, basic experimental research examining the assumptions underlying these packaged interventions is warranted. Specifically, research investigating the necessity of highly-trained interventionists, several-session treatments, and multiple types of mindfulness-based practices is likely to be especially useful for optimizing evidence-based practice in this area. The

purpose of the present study was to target these issues by examining the immediate effects of a single-use mindful body scan exercise—administered via audio recording—on risk-taking behaviors within a lab setting. Participants completed self-report measures of state and trait mindfulness and a behavioral measure of risk-taking, were randomly assigned to listen to a 10-minute mindful body scan or control audio recording, and then completed the self-report and behavioral measures once more. Changes in risk-taking behavior and their relation with changes in state and trait mindfulness were analyzed. It was hypothesized that participants in the mindful body scan group would show greater reductions in risk-taking behavior compared to the control group, and that changes in risk-taking would be mediated by changes in state mindfulness but not trait mindfulness.

METHOD

Participants

Participants were enrolled in undergraduate psychology courses at a major southern university and signed up for the study using the university's online research participation management system. A total of 153 undergraduate students participated in this study. An a priori power analysis indicated that, with an estimated effect size of $d = 0.38$ (Wilson et al., 2015), 87 participants were needed in each group to obtain a power of 0.80. The final sample had 76 participants in the body scan meditation group and 77 participants in the mind wandering group. The original goal of 174 participants was not met due to time constraints. Informed consent and demographic information from each participant was collected (e.g., age, ethnicity, gender). The study participants were 76.47% female. The participants were 74.51% white, 16.34% black or African-American, 5.88% Asian, 0.65% American Indian/Alaskan Native, and 2.61% were of other races. Of the total sample, 7.91% of the participants identified as Hispanic. The age of participants ranged from 18 to 60 years, with a mean of 19.87 years. The sample was 45.1% freshmen, 26.14% sophomores, 12.42% juniors, and 16.34% seniors.

Procedure

A trained researcher met with the participant at their assigned time to describe the study, answer any questions, and obtain informed consent. Following the consenting procedure, participants filled out preliminary questionnaires, including trait and state mindfulness measures. They then began the computer-based risk-taking task. Once the participants completed the risk-taking task, they were randomly assigned to either the mindfulness induction condition or the control condition.

To ensure random assignment with roughly equal groups, the researcher made 174 slips of paper beforehand wherein 87 were “control” and the other 87 were “experiment”. When the time came for the participant to be assigned, the researcher selected a random slip of paper from an envelope. The participant then listened to the audio based on their assignment of experimental condition. The participants in the mindfulness condition listened to a brief, 10-minute version of the body scan practice. This audio-guided practice instructs listeners to be mindful of certain focal points in the body. As mentioned above, the body scan practice has been shown to produce immediate psychological effects (Cropley et al., 2007; Hamilton, Fawson, May, Andrade, & Kavanagh, 2013; Ussher et al., 2014). Participants in the control condition listened to a 10-minute mind wandering audio recording in which they were instructed to think about “whatever comes to mind.” Research has shown that mind wandering produces no therapeutic effects when used as the control condition in other mindfulness-based manipulation studies (Wilson et al., 2015). Following the induction, the participants filled out the state and trait mindfulness questionnaires again and then completed the computer-based risk-taking task once more. The session ended with further post-experiment questionnaires (e.g., demographics). The entire experiment, including consenting through debriefing, lasted approximately 45 minutes.

Measures

Risk-taking behavior. Level of risk-taking behavior was assessed using the balloon analogue risk task (BART; Lejuez et al., 2002). In the BART, each participant is presented with a balloon and is instructed to pump up the balloon using a button on the screen. With each pump of the balloon, the participant earns money; however, the balloon will over inflate and explode at a threshold unknown to the participant, which results in a loss of all money earned, and thus each pump of the balloon also increases the risk of popping the balloon and losing money. The

participant may choose at any point to cash out and collect the money, but if the balloon explodes, the participant loses all money earned during that trial. Risk-taking is therefore measured by the average number of pumps on unexploded balloons, with higher averages indicative of increased risk-taking propensity. Participants completed 20 trials of the BART at both pre-test and post-test.

Trait mindfulness. The Mindful Attention Awareness Scale (MAAS) was used to assess the level of trait mindfulness in each participant across both conditions (Brown & Ryan, 2003). This self-report scale consists of 15 items, has been demonstrated to possess good internal reliability (Cronbach's α = .85 at pre-test and .88 at post-test in the present study), and has been used in numerous studies to assess trait mindfulness in adult populations. Participants answer questions based on their average, day-to-day experience. Sample items include, "I drive places on 'automatic pilot' and then wonder why I went there" and "I snack without being aware that I'm eating." Participants responded to each item using a 6-point Likert-type scale (e.g., 1= *almost always* to 6 = *almost never*).

State mindfulness. The State Mindfulness Scale (SMS) was used to assess the current levels of state mindfulness in participants (Tanay & Bernstein, 2013). This self-report scale consists of 21 items and has been demonstrated to possess good internal reliability (Cronbach's α = .94 at both pre- and post-test in the present study) and has been used in several studies to assess state mindfulness in adult populations. Participants answer questions based on their experiences in the past 10-15 minutes. Sample items include, "I noticed thoughts come and go" and "I felt aware of what was happening inside of me." Participants respond to each item using a 5-point Likert-type scale (e.g., 1 = *not at all* to 5= *very well*).

Data Analysis

Differential changes in risk-taking behavior (BART scores) between the mindfulness induction and control groups were examined via analyses of variance (ANOVA). Before the primary statistical analyses were run, pre-induction differences on the process and outcome variables were examined. If pre-induction differences were identified, then analyses of covariance (ANCOVA) would be run using relevant baseline scores as covariates. Given no pre-induction differences were found, however, primary analyses were conducted using repeated-measures one-way ANOVA. Following, the relationships between changes in the outcome and process variables was examined by calculating change scores (Time 1 – Time 2) for all variables and conducting bivariate correlations between these scores. If a significant and meaningful relationship would have been observed between state mindfulness and risk-taking propensity, then a path analysis would have been conducted using AMOS to investigate the potential mediating relations between changes in state and trait mindfulness and changes in risk-taking behavior. However, these additional analyses were ultimately deemed unnecessary. All data analyses were conducted using SPSS version 24.

RESULTS

Preliminary Analyses

Descriptive statistics were examined for the total sample at both time points (see Table 1). All study variables were relatively normally distributed and characterized by adequate internal consistency at Time 1 and Time 2. ANOVA tests were run to determine any pre-intervention differences on both process and outcome variables. There were no significant differences found between conditions on state mindfulness, $F(1, 151) = 2.43$, $p = .12$, trait mindfulness, $F(1, 151) = .11$, $p = .75$, or BART scores, $F(1, 151) = .81$, $p = .37$ at Time 1, thus an ANCOVA was not needed. Bivariate correlations were also run for all study variables at each time point (see Table 2). There was a small, positive correlation between MAAS scores and SMS scores at both pre-test ($r = .34$) and post-test (also $r = .34$). There was a small, negative correlation between pre-test BART scores and post-test SMS scores ($r = -.18$).

Table 1. Descriptive Statistics for All Study Variables

	Pre-test			Post-test		
	M (*SD*)	Skewness	Kurtosis	*M* (*SD*)	Skewness	Kurtosis
MAAS	3.69 (.72)	0.42	0.3	3.48 (.79)	0.49	0.23
SMS	3.12 (.82)	0.003	-0.55	3.45 (.78)	-0.41	-0.45
BART	36.70 (14.22)	0.12	0.004	38.97 (13.24)	0.15	0.04

Table 2. Bivariate Correlations for All Study Variables at Both Time Points

	Pre-test			Post-test		
	MAAS	SMS	BART	MAAS	SMS	BART
Pre-test						
MAAS	1	.34**	-0.06	.88**	0.09	-0.03
SMS		1	-0.08	.34**	.48**	-0.11
BART			1	-0.04	-0.18*	0.73**
Post-test						
MAAS				1	0.09	0.01
SMS					1	-0.08
BART						1

*$p < .05$ **$p < .01$

Primary Analyses

A repeated measures one-way ANOVA was run on BART scores at Time 1 and Time 2. Group sizes were roughly equal, with 76 participants in the body scan meditation group and 77 participants in the mind wandering group. Several univariate outliers were detected after converting the dependent variables into z-scores; however, they were not excluded from these analyses because they were likely indicative of credible response patterns. Levene's test of error variances was not significant and Box's test of covariance matrices was also not significant, suggesting both homogeneity of variance and covariance. The assumption of linearity was met as there were no curvilinear relationships detected.

ANOVA findings showed that there was no significant interaction of SMS score and condition over time, $F(1, 151) = 1.31$, $p = .25$, $\eta_p^2 = .009$. However, there was a significant main effect of time characterized by a large effect size, $F(1, 151) = 25.15$, $p < .01$, $\eta_p^2 = .14$. Similarly, there was no significant interaction of MAAS score and condition over time, $F(1, 151) = .50$, $p =$

.48, $\eta_p^2 = .003$, yet there was a significant main effect of time characterized by a large effect size, $F(1, 151) = 47.06$, $p < .01$, $\eta_p^2 = .24$.

ANOVA findings also indicated that there was no significant interaction of BART score and condition over time, $F(1, 151) = 0.09$, $p = .77$, $\eta_p^2 = .001$. There was, however, a significant main effect of time characterized by a small effect size, $F(1, 151) = 7.65$, $p < .01$, $\eta_p^2 = .05$, suggesting both groups changed slightly from pre-test to post-test (see Figure 1). The observed power for the main effect of time was .79 and .06 for the interaction. Given the lack of interaction effects, no post-hoc comparisons were conducted.

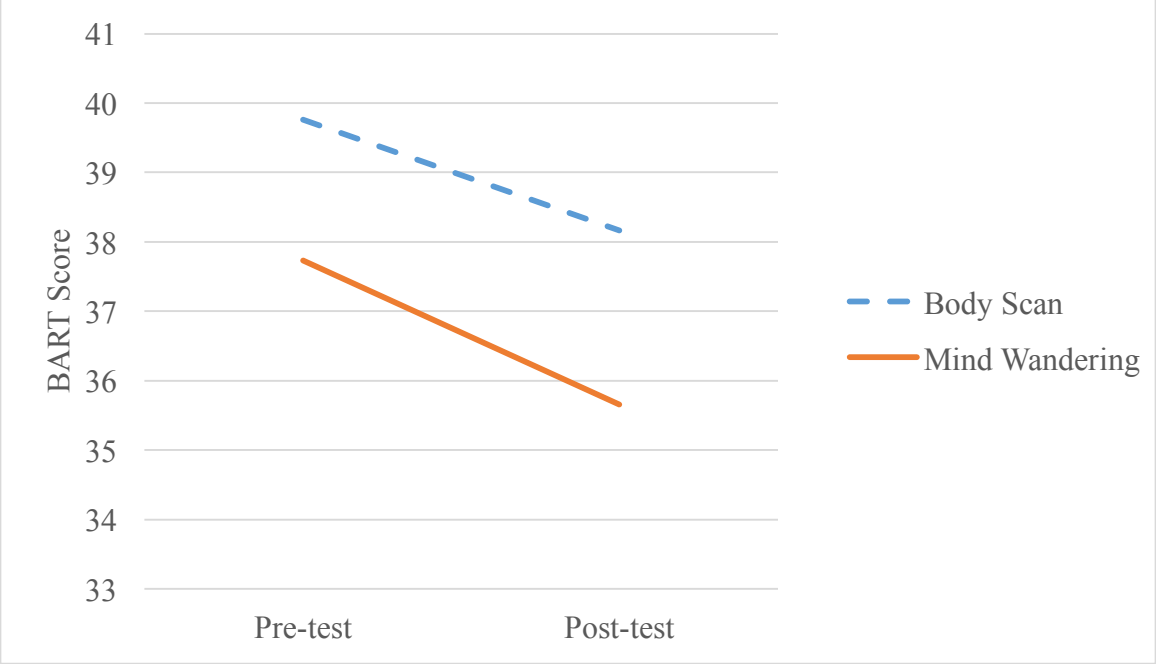

Figure 1. Profile Plot of Time Main Effect

Change scores (Time 1 – Time 2) for both mindfulness variables and the risk-taking variable were calculated and bivariate correlations were run to test the relationship among changes in mindfulness and risk-taking. Given there were no interaction effects found, this analysis was conducted using the total sample to maximize statistical power. Results indicated a small but significant correlation between the change in state mindfulness and the change in

BART scores (r = .18, p < .05). There were no significant correlations between change in state mindfulness and change in trait mindfulness (r = -.06, p > .05) nor between change in trait mindfulness and change in BART score (r = .04, p > .05). Given the lack of interaction effects noted earlier as well as the marginal relationships observed via correlations in change scores, further analyses testing the potential mediating role of mindfulness on risk-taking behavior were deemed unnecessary.

DISCUSSION

The purpose of this study was to examine the effect of the mindful body scan practice on risk-taking behavior in a lab setting. Risk-taking behavior is a component of several psychological disorders and several mindfulness programs have been shown to successfully target this type of behavior. These previous studies involve practicing mindfulness over time (e.g., one three-hour class per week for 8 weeks with daily practice), whereas this study aimed to understand potential immediate effects of a mindfulness-based meditation (the body scan) on a computer-based risk-taking paradigm. Participants completed pre-test measures of trait and state mindfulness and the BART paradigm, were randomly assigned to listen to the mindful body scan or a mind wandering audio (control), and then complete the BART task a second time and fill out the same measures of mindfulness post-test. The entire experiment was completed in one session in a lab setting.

Results from repeated measures ANOVA demonstrated that there was no effect of condition on participants' BART scores. Both groups had significantly decreased BART scores at post-test—indicating a reduction in risk-taking propensity—however, there was no interaction, which suggests that this pattern was not due to the condition to which the participants were assigned. Furthermore, results indicated that participants in the mindful body scan group did not experience a decrease in state levels of mindfulness over and above the mind wandering group. This suggests that the audio used in this study did not significantly influence state levels of mindfulness, which was the process variable hypothesized to mediate change in the outcome variable. The lack of effect of condition on level of state mindfulness is likely why no interaction over time was observed regarding BART scores. However, there was a small, significant positive correlation between the change in state mindfulness and the change in BART scores for the total

sample—although there was no initial correlation between levels of state or trait mindfulness and performance on the BART. There was also no interaction effect observed for condition and trait mindfulness as well as no correlation observed between changes in trait mindfulness and changes in risk-taking propensity, which was expected. Thus, although the experimental hypothesis regarding between-group differences in risk-taking was not supported, marginal support was evidenced for the relationship between changes in state mindfulness being related to changes in risk-taking propensity.

Limitations

There are several limitations of note in the current study. First, the mindful body scan audio did not make participants significantly more mindful than the mind wandering audio. This could be for several reasons. It is possible that this audio—which is a shortened version of the regular 45-minute body scan—was not long enough to effect a meaningful change in level of mindfulness. The body scan audio used for the current study was 11 minutes long and future studies should look at the length of meditations and how the length impacts state mindfulness scores. Previous research looking at the impact of mindfulness meditations on state mindfulness has primarily looked at multiple sessions over time (Hadash, Segev, Tanay, Goldstein, & Bernstein, 2016; Shoham, Goldstein, Oren, Spivak, & Bernstein, 2017; Tanay & Bernstein, 2015). The lengths of these practices are similar to therapies described in extant research looking at the influence of mindfulness-based practices on other outcomes (Khoury et al., 2013a). Furthermore, the measure of state mindfulness that was used (the SMS) may not be particularly sensitive to change and any changes in state levels of mindfulness may have gone undetected. Studies that have used this measure have looked at how scores change over time, but not within one session (Hadash et al., 2016; Shoham et al., 2017; Tanay & Bernstein, 2015). Further

research should examine how this measure changes regarding the type of audio one is listening to (i.e., mind wandering, relaxation, mindfulness-based meditation) and how quickly it changes.

It is also possible that the participants were not engaged with the audio. Participants were told to "follow along with the relaxation audio"—however, it may have been necessary to give them more direction to prepare themselves (e.g., telling them to close their eyes or look down at their hands, fix their posture, etc.). It also may have been necessary to tell the participants that the audio was a meditation rather than a simple "relaxation audio." Further research should examine how priming a mindfulness-based audio impacts its therapeutic effectiveness.

Additionally, this study used just one risk-taking paradigm to assess level of riskiness. Inclusions of other paradigms or perhaps a self-report to assess state and trait levels of riskiness—such as the Impulsivity Behavior Scale (Lynam, Smith, Whiteside, & Cyders, 2006) or the Risk Taking Index (Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005)—potentially would have provided better information as to how mindfulness plays a role in influencing riskiness. It is also possible that the BART is not particularly sensitive to change. The BART is not typically utilized in this manner (i.e., single session research); however, previous research has shown that risk-taking scores significantly increase when the BART is administered within the same day (Lejuez et al., 2003). Although BART scores did decrease following the audio inductions, because the BART is not typically used within this research, another measure of risk-taking may have been more appropriate.

Future Directions

Future studies are needed to investigate the relationship between levels of mindfulness and risk-taking behavior using alternate methods. Previous research has shown that higher levels of mindfulness is related to reduced risk-taking behaviors such as smoking, binge-eating, and

alcohol use (Black et al., 2012; Cropley et al., 2007; Reynolds et al., 2015). Future studies should look at how and why this pattern appears. Experimental research regarding mindfulness-based practices and risk-taking propensity is lacking (as discussed in the Introduction), and further research is needed to determine which components of mindful practices are the most salient in impacting risk. This study employed the use of just one mindfulness-based meditation and other practices may be more likely to show immediate changes (e.g., mindful breathing, mindful eating). It is not currently known which mindfulness-based practices impact risk-taking—or whether it is a combination of several practices. The current lack of rigorous component analyses in the mindfulness literature preclude the knowledge of how exactly mindfulness and other mindfulness-based therapies work to reduce certain problem behaviors (Levin, Hildebrandt, Lillis, & Hayes, 2012; Roemer & Orsillo, 2003). Additionally, it is possible that these components cannot be effective without repeated practice. Indeed, some studies have looked at the time spent in mindfulness-based practice and its impact on clinical outcomes; however, these studies are correlational and do not specify the amount or quality of practice needed for effectiveness (Grow, Collins, Harrop, & Marlatt, 2015; Morgan, Graham, Hayes-Skelton, Orsillo, & Roemer, 2014). Thus, further research is needed to determine the nuance of mindfulness-based practices and how they may effect change, both immediately and over time.

Additional research is also needed to understand how and whether mindfulness-based practices can be implemented without a teacher. Although it is recommended to have a teacher—who also practices mindfulness—to implement mindfulness-based practices, this has never been explicitly examined (Kabat-Zinn, 1990). This study employed the use of pre-recorded audio and found that it had no differential impact on risk-taking behavior compared to an active control condition. It may be that more practice with the help of a teacher is needed to effectively

influence propensity for risk-taking via mindfulness. However, previous research has shown that mindfulness-based practices can be effective without others' involvement (Fish, Brimson, & Lynch, 2016). Further research can parse out how best to implement mindfulness-based practices and what conditions are necessary for maximum effectiveness (Roemer & Orsillo, 2003).

Summary

The present study examined how the mindful body scan practice impacts risk-taking behavior within a laboratory setting. Participants completed pre-test measures (state and trait mindfulness) and the BART, were randomly assigned to either the mindful body scan audio or the mind wandering (control) audio, and then completed the post-test mindfulness measures and the BART task once more. It was hypothesized that those in the mindful body scan group would have significantly reduced risk-taking propensity and that this reduction would be mediated by change in level of state mindfulness. Results showed, however, that the mindful body scan audio did not have a differential impact on either level of state mindfulness or risk-taking as measured by the BART. Rather, both groups evidence significant changes in both state mindfulness and risk-taking propensity. Thus, mediation analyses were not run. This was a preliminary study and is not without limitations. Further research is needed to determine how best to measure risk-taking propensity in a laboratory context, how exactly mindfulness-based practices impact risk-taking behaviors, and what interventions best target them.

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VITA

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Following her undergraduate career, Shelley worked at innovation, Research, & Training, Inc. (iRT) in Durham, North Carolina for three years. There, she worked on the development of three mindfulness education programs and an online mindfulness program designed for adolescents diagnosed with fetal alcohol spectrum disorder. Shelley's interest in education and mindfulness led her to Louisiana State University where she is receiving her doctor of philosophy in school psychology under the supervision of Dr. Tyler Renshaw. Her research interests center on mindfulness and how it can be utilized to delay or prevent the onset of risk behaviors.