Does Trait Mindfulness Moderate the Effect of Stress on Executive Control?

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Abstract

Stress can impair one's ability to effectively problem solve and think critically. This study tested the extent to which trait mindfulness moderated the relation between stress and executive control (EC). Participants were 112 college students ($Mean_{age}$ = 19; SD = 1.1) participating in research for credit. At the first session (Time 1), we assessed trait level mindfulness, current depressive symptoms, and EC using an emotional n-back task. At the second session, a week later, we assessed EC again following a stress induction task. Participants were randomized to either a high or low stress condition. Finally, participants again completed the measure of depressive symptoms at the follow-up assessment conducted during the week of finals. We hypothesized that higher levels of mindfulness would predict better performance on the post-stress EC task and lower levels of depressive symptoms at follow-up. Results indicated, however, that trait mindfulness did not predict performance on the EC task or follow-up depression scores. Limitations of the study, particularly the small sample size, are discussed.

Introduction

Depression is a common mental health problem, with about 16% of people experiencing an episode of depression at least once during their lifetime (Akhtar-Danesh & Landeen, 2007). Depression is one of the most debilitating forms of mental illness, with over $75 billion annually lost in productivity in the work place (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Therefore, efforts to understand the onset, course, and treatment of depression are needed.

Stress, which is experienced by everyone at various points in their lives, can impair one's ability to effectively problem solve and think critically. These skills are referred to as executive control (EC), which includes abilities such as planning goals, solving problems, and flexibly using information (Betancourt, 2007). People who have impaired EC as a result of exposure to stress are also more likely to experience depressive symptoms and other psychopathology when faced with adverse circumstances (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Quinn & Joormann, 2015b; Snyder, 2013).

Quinn (2017) proposed a model to explain the relations among stress, executive control, and depression (see Figure 1). According to this model, exposure to stress produces physiological arousal and disturbances in executive control that result in symptoms of psychopathology, particularly depression. Moreover, the link between impaired EC and increased depressive symptoms is partially mediated by a decrease in the ability to cognitively reappraise the stressful situation and an increase in rumination about the negative effects of the stressor. Although this series of events can happen to anyone given that everyone experiences stress, not everyone develops depression.

Executive Control

Executive control is not a single cognitive ability or list of skills that has one universally accepted definition (Betancourt, 2007). Rather, certain skills are considered part of executive

control. One such skill is attentional control that includes selective attention and inhibition, which allows people to focus on important information and ignore distracting stimuli in problem-solving settings. Another important EC skill is working memory, which involves the storage and manipulation of new information (Betancourt, 2007). Tests of working memory often examine how well individuals can update their working memory and incorporate new information into decisions.

Two correlates of EC are emotion regulation and rumination. Regarding emotion regulation, cognitive control allows one to inhibit negative emotions and to focus attention on a desired affective state, and then work toward achieving a goal. Rumination is the continued focus on one's own negative affect and stressful situation, which tends to maintain the negative emotion instead of solving the problem or changing one's emotional state (Quinn & Joormann, 2015b). Individuals who have trouble updating their working memory are more likely to ruminate and stay focused on certain negative situations or emotions instead of taking steps to change their emotional state or stressor.

Executive Control and Psychopathology

Impairments or deficits in executive control have been associated with symptoms of depression (Snyder, 2013). Moreover, the tendency to ruminate is associated with symptoms of depression, anxiety, eating disorders, and substance abuse problems (Aldao et al., 2010; Quinn & Joormann, 2015b). Rumination reflects a deficit in the ability to update working memory and is a type of EC deficit. Impairment in the ability to update working memory itself also predicts depressive symptoms over time (Quinn & Joormann, 2015b, 2015a). In addition, poor emotion regulation skills likely lead to symptoms of depression in individuals who cannot effectively change their affective state when they experience negative emotions (Aldao et al., 2010).

Understanding the causes of such impairments in EC and related skills will help to identify ways to prevent it from occurring in the first place.

Stress and Executive Control

Executive control is relatively stable across time and typically is measured only once (Snyder, 2013). EC has been found to change, however, depending on the extent of stress at the time of the assessment, either acute (Quinn & Joormann, 2015a) or chronic (Jha et al., 2010). For example, Jha et al. (2010) showed that as stress levels increased over time, EC scores got worse. Quinn and Joormann (2015a, 2015b) demonstrated a causal relation between stress exposure and EC using an experimental paradigm in which participants were randomly assigned to a high versus a low stress condition. Those in the high stress induction showed greater impairment in EC as compared to those in the low stress condition. Moreover, participants who experienced more severe impairments in EC as a result of exposure to stress were more likely to experience depressive symptoms during a stressful time later (Quinn & Joormann, 2015b). Thus, although EC is relatively stable, exposure to stress can decrease performance on measures of EC.

Mindfulness

Mindfulness involves the practice of meditation and originally comes from Buddhist tradition (Kabat-Zinn, 2003). Mindfulness in Western cultures, particularly when used scientifically, takes the core aspects of mindfulness and detaches them from the religious context from which they come. Mindfulness practice aims to bring awareness to thoughts and emotions without judgement or emotional reactions to them. A related goal is to allow wandering thoughts to come and go without focusing direct attention on them (Kabat-Zinn, 2003).

Mindfulness practice is associated with improvements in working memory (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), decreased rumination (Hindman, 2013), improved emotion regulation (Teper, Segal, & Inzlicht, 2013), voluntary attention (Jha, Krompinger, & Baime,

2007), reduced stress (Shapiro et al., 2008), reduced symptoms of depression (Arch & Craske, 2010), and fewer residual symptoms of depression in those in recovery from recurrent depression (Radford et al., 2014). Presumably, mindfulness decreases rumination by improving both attentional control and working memory (Jha et al., 2007; Teper & Inzlicht, 2013). Better attentional control would reduce rumination by diverting attention away from negative stimuli to different or more positive stimuli. Better working memory would make it easier to bring new information into mind and thereby escape ruminative habits (Jha et al., 2010). Thus, mindfulness can improve multiple aspects of EC and skills associated with it, bolstering one's effectiveness in dealing with stressful situations and protecting against the onset of depression.

Mindfulness skills can be cultivated through meditation and deliberate practice, but there also exist individual differences in natural mindfulness, which is referred to as trait mindfulness. Individuals with higher trait mindfulness tend to ruminate less and have better emotion regulation skills (Paul, Stanton, Greeson, Smoski & Wang, 2012; Mesmer-Magnus, Manapragada, Viswesvaran & Allen, 2017). Trait mindfulness acts as a protective factor against developing depression in those who have experienced childhood maltreatment (Beshai & Parmar, 2018). Neurobiological research has shown that those with high trait mindfulness have increased functional connectivity in brain regions associated with EC and attentional control (Parkinson, Kornelsen & Smith, 2019).

The Current Study

The current study expanded upon the model in Figure 1 by proposing that trait mindfulness plays a role in breaking the links among stress, EC, and depression (see Figure 2). According to this model, trait mindfulness reduces the negative effects of stress on executive control, and the associated rumination, emotion dysregulation, and psychopathology. One aim of the current study was to explore the extent to which trait mindfulness moderated the relation

between exposure to an acute stressor and executive control. Previous research has shown that mindfulness training improves executive control and reduces stress in general (Goldin & Gross, 2010; Teper & Inzlicht, 2013). The present study tested whether the effect of an acute stressor on executive control (Quinn & Joorman, 2015a) varied as a function of individuals' levels of trait mindfulness.

Thus, building upon the work of Quinn and Joorman (2015a), we first aimed to replicate the effects of stress on EC, and then test whether mindfulness moderated this relation. We hypothesized that individuals randomized to the high stress condition would show greater impairment in the measure of EC as compared to individuals in the low stress condition. The second hypothesis was that among participants randomized to the high stress condition, higher trait mindfulness would predict less impairment in EC as compared to those low in trait mindfulness. Third, we hypothesized that high trait mindfulness would predict fewer depressive symptoms at follow-up as compared to those with lower trait mindfulness.

Method

Participants: Participants were undergraduate students recruited through the Vanderbilt SONA online recruitment system. They ranged in age from 18 to 22 years old (Mean =19; SD = 1.1); all participants were English speakers. The sample consisted of 112 participants, (85% female). The racial breakdown was 38% white, 35% Asian, 14% black, 2% middle eastern and 8% mixed race. The ethnic breakdown was 8% Hispanic and 92% non-Hispanic. Any participant who reported current suicidal ideation or high depression scores, defined as a 25 or above on the BDI-II, received a more thorough evaluation to assess "imminent danger." The experimenter contacted the faculty advisor or postdoctoral fellow who would determine next steps to deal with the situation.

Study Design: The independent variable in this between-groups design was to which stress condition (high vs. low) participants were randomized. We stratified random assignment by gender to keep a balanced proportion of males and females in each condition. The high stress condition was based on the Trier Social Stress Test procedure (Kirschbaum, Pirke, & Hellhammer, 1993). Participants (n = 66) were instructed to give a 5-minute speech about why they would be the ideal job applicant for a vacant position that would be videotaped and rated by a group of their peers. They next completed a 5-minute math task requiring them to count backwards from 2083 in increments of 17. The experimenter stayed in the room.

In the low stress condition, participants (n = 36) were instructed to give a 5-minute speech about whatever topic they wanted to talk; there was no camera or implied evaluation and the experimenter left the room while the participant talked. They then spent 5 minutes counting from 0 in increments of 15, again without the experimenter present (Kirschbaum, Pirke, & Hellhammer, 1993).

Materials

Depressive Symptoms. At baseline (Time 1) and follow-up (Time 2), participants completed several questionnaires, including the Beck Depression Inventory, second edition, BDI-II (Beck, Steer & Brown, 1996), which measures symptoms of depression. The BDI-II has demonstrated both criterion validity and test-retest reliability (Pearson's $r = .96$, $p<.05$) (Sprinkle et al., 2002).

Mindfulness. The short Kentucky Inventory of Mindfulness Skills, or short KIMS, (Höfling, Ströhle, Michalak, & Heidenreich, 2011), is a 20-item measure of mindfulness with four subscales and an overall score ranging from 0-100. Each item is scored on a Likert scale from 1 to 5. A score of 1 = never or very rarely true, 2 = rarely true, 3 = sometimes true, 4 = often true, and 5 = very often or always true. The four subscales (observe, describe, awareness,

and accepting without judgement) measure different aspects of mindfulness and associated skills. The *observe* subscale measures how well one notices different sensational experiences. An example item is "When I'm walking, I deliberately notice the sensations of my body moving." The *describe* subscale measures how well one can verbalize their experiences. An example item is "I'm good at finding the words to describe my feelings." The *awareness* subscale measures how aware one is of his or her surroundings while they are doing something. An example item is "When I do things, I get totally wrapped up in them and don't think about anything else." The *accepting without judgement* subscale measures how well one can recognize his or her thoughts or emotions without reacting negatively to them. An example item is "I think some of my emotions are bad or inappropriate and I shouldn't feel them." The short KIMS has demonstrated good reliability and validity (Höfling, Ströhle, Michalak, & Heidenreich, 2011). All self-report measures were completed using REDCap, which is an online tool for creating surveys and collecting data.

Executive Control. A two-back version of the n-back task was used to measure executive control. The n-back measures both general EC and the updating specific component of executive control (Chatham et al., 2011; Snyder, Miyake & Hankin, 2015). This task has demonstrated acceptable construct validity and reliability (Miyake & Friedman, 2012). In the n-back task, participants are presented with a series of words, one at a time, and are asked to indicate whether the current word is the same as the word presented two words earlier in the sequence.

The stimuli presented are positive and negative words selected from the Affective Norms of English Words list (Bradley & Lang, 1999). The words chosen for this task were used in Quinn and Joormann (2020) and were selected based on normed ratings of valence and arousal provided by the Affective Norms of English Words list. Words were rated on a scale from 1 to 9. Quinn and Joormann (2020) reported that positive (M = 5.91, SD = 1.09) and negative words (M

= 6.33, *SD* = .79) did not differ in arousal ratings, $t(28) = 1.22$, $p = .232$, Cohen's $d = .44$, nor did positive ($M = 6.07$, $SD = 1.75$) and negative words ($M = 6.13$, $SD = 1.77$) differ in word length, $t(28) = .10$, $p = .918$, Cohen's $d = .03$. Affective stimuli were used to be consistent with previous findings that improvements in EC over affective material, specifically, was associated with gains in emotion regulation (Cohen, Mor, & Henik, 2015; Schweizer et al., 2013).

Participants completed a series of 120 trials during which a word was displayed for 500 milliseconds (ms) followed by a blank screen presented for 2500 ms. Participants indicated quickly and accurately whether the word matched or did not match the word that was presented two trials previously. Total number of errors made during the task was the measure of executive control performance, with fewer errors indicating greater EC (Snyder et al., 2015).

Procedure: Before participants arrived for session 1, they completed the BDI-II and KIMS on REDCap. At the beginning of session 1, participants read and signed the informed consent form. Then they completed the n-back task, which provided baseline executive control scores. Each task has a set of practice trials in which participants must get 90% correct in order to move on to the actual task. This is to ensure that they fully understood the directions.

Session 2 occurred one week later. The experimenter administered the TSST to the participant, using the high or low stress protocol based on the participant's randomization. Immediately following the TSST, participants completed the n-back task again. Before leaving, the experimenter debriefed participants in the high stress group regarding the deception that had occurred. At the end of the semester during finals, each participant was emailed the link to complete the follow-up BDI-II (Time 3) and was given a $10 gift card upon completion.

Results

Table 1 presents the means, standard deviation, and correlations of all study variables.

Table 1
Summary of All Study Variables

		Pearson's r Correlation											
Measure	Mean (SD)	Age	Sex	T1 BDI	T3 BDI	T1 EC	T2 EC	Total KIMS	Observe	Describe	Aware	Accept	Stress
Age	19 (1.1)	-	-.05	.15	.25*	-.17	-.04	.07	.11	-.06	.10	-.03	.01
Sex			-	-.04	-.02	.11	-.01	-.10	-.16	-.22*	.04	.15	.08
T1 BDI	10.7 (10.2)			-	.57**	-.01	.14	-.23*	.14	-.19	.15	-.47**	.15
T3 BDI	9.9 (9.5)				-	.07	.20	-.16	.11	-.10	.02	-.33**	.03
T1 EC	15.5 (7)					-	.45**	.02	-.10	.09	.02	.06	-.04
T2 EC	11.3 (5.6)						-	-.07	-.13	.04	.06	-.05	.17
Total KIMS	62.9 (8.4)							-	.59**	.61**	.34**	.45**	.06
Observe	18.2 (5)								-	.20	.19	-.27**	.02
Describe	16.6 (3.8)									-	-.09	.11	.09
Awareness	11.6 (2.7)										-	-.09	-.03
Accept without Judgement	16.4 (4.9)											-	.04
Stress Condition													-

Note. *significant at the 0.05 level (2-tailed).
**significant at the 0.01 level (2-tailed).

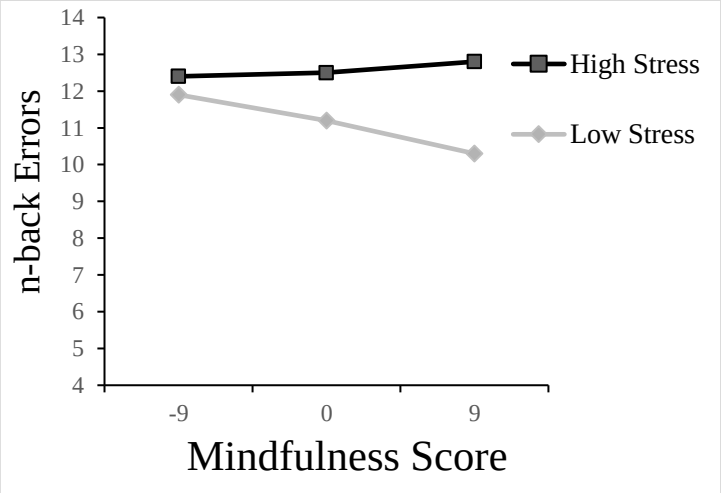
All data were processed in SPSS, where syntax was created to score all surveys and relevant subscales. Six participants completed the baseline surveys but did not attend either session, and two participants did not show up for session 2. One participant dropped out of the study during session 2. Additionally, analyses using follow-up data had a smaller sample because 15 participants did not complete the follow-up surveys.

To test the first hypothesis that participants in the high stress condition would perform worse on the post-stress n-back task than those in the low stress condition, we conducted a one-way ANCOVA with post-stress n-back scores as the dependent variable, stress condition as the independent variable, and baseline n-back scores as the covariate. The results showed no significant difference in group means between the low- (M=11.22, SD=5.91) and high-stress

(*M*=12.48, *SD*=5.93) groups, $F(1,62) = 1.22$, $p = .274$. The effect size was small, $\eta^2 = .019$. Difference scores indicated that in both groups, participants did better on the post-stress test than the baseline ($M_D = 4.19$, $SD = 6.66$).

To test the second hypothesis that the relation between stress and executive control would be moderated by mindfulness, we conducted a linear regression with post-stress n-back scores as the dependent variable, and T1 n-back scores, stress condition, and mindfulness scores (from the KIMS) as the independent variables. The interaction between mindfulness and stress condition in predicting change in n-back scores was not significant, F (1, 61) = .515, $p = .476$, β= .108, $t(64) = .716$, $p = .477$.

Although the interaction was not significant, we conducted an exploratory, post hoc examination by plotting it. This figure shows the direction of the associations between mindfulness and n-back errors for the high- and low-stress groups. In the low-stress condition, higher levels of mindfulness were associated with fewer n-back errors, whereas in the high stress condition, level of mindfulness was not related to the extent of n-back errors. Given that the interaction was not significant, however, this must be interpreted with much caution.



To test the third hypothesis that trait mindfulness would predict depressive symptoms, we conducted both correlational and regression analyses. Table 1 presents the correlations of the KIMS total score and each subscale with baseline and follow-up depression scores. The KIMS total scores and the *accepting without judgement* subscale correlated significantly depression

(BDI) indicating that higher overall mindfulness and *acceptance without judgement* significantly correlated with lower levels of depressive symptoms.

We conducted separate regression analyses to determine if overall KIMS scores or each individual subscale would predict T3 depression scores, controlling for T1 depression. Table 2 presents these results. None of the mindfulness scores significantly predicted T3 depression, once T1 depression was controlled.

Table 2

Mindfulness Total Score and Subscales Predicting Depressive Symptoms at T3 Controlling for T1

	Regression Outputs	
KIMS Score	Standardized Coefficient β	*p*
Overall Score	.007	.94
Observe Subscale	.024	.796
Describe Subscale	.071	.449
Awareness Subscale	-.04	.661
Accept Without Judgement Subscale	-.055	.591

Note. KIMS = Kentucky Inventory of Mindfulness Skills

Discussion

The three aims of the current study were to examine: (a) the effect of an acute laboratory stressor on executive control, (b) whether trait mindfulness moderated this relation, and (c) the relation between trait mindfulness and depressive symptoms concurrently and prospectively. The high versus low stress groups did not differ significantly on EC at Time 2, controlling for EC at Time 1. Second, trait mindfulness did not significantly moderate this relation. Finally, there were significant negative correlations between baseline trait mindfulness and both baseline and follow-up depression scores for the *accept without judgement* subscale of the KIMS. Mindfulness did not predict depressive symptoms at follow-up, however.

The nonsignificant differences in EC scores for those in the different stress conditions was unexpected. The Trier Social Stress Test is a reliable method for inducing stress in a laboratory setting (Frisch, Häusser & Mojzisch, 2015), and the effect of this stressor on executive control has been documented previously (Quinn & Joormann, 2015a, 2015b). Quinn and Joormann found that participants in the high stress condition did significantly worse on the n-back task immediately after the TSST than did those in the low stress group. It is possible that we did not detect significant differences due to the small samples size. Other methodological differences also might have affected the results. In previous research, the participant only met the research assistant once to administer the TSST once. In our study, the participant met the research assistant during session 1 and then completed the TSST with that same experimenter during session 2, which occurred one week later. It is possible that the stress induction did not work as well in this study because the participant was already somewhat familiar and comfortable with the experimenter, given that they had worked together the previous week. A degree of familiarity and rapport with the experimenter in our study could have dampened the effect of the high stress condition. Second, the lack of stress condition differences on EC might have been due to practice effects. The participant completed a baseline measure of the dependent variable one week prior, and in both instances the n-back task presented the same words in the same order.

Trait mindfulness was correlated significantly with the measure of depressive symptoms at Time 1, but mindfulness did not moderate the relation between stress and EC. These results together indicate that there is a relation between mindfulness and depression, but it may not occur through differences in executive control. The relation between trait mindfulness and depression might be more direct, especially given that the strongest correlation was for the *accepting without judgement* subscale of the KIMS. The idea of acceptance in mindfulness refers

to the ability to recognize and accept one's own thoughts, beliefs, reactions and emotions without having negative reactions to or judgements of them. Someone who is mindful is likely to accept that they are upset and move on, whereas someone who is not as mindful is more likely to have negative thoughts about whatever situation prompted the distress.

Cognitive models of depression posit that maladaptive thoughts and beliefs are important vulnerabilities to depression. Thus, it makes sense that those who are more mindful, especially on the *accepting without judgement* dimension, would be less likely to become depressed when experiencing the same stressor as someone who is less mindful. This is relevant to the current study because we obtained the follow-up measures of depression during finals at the end of the semester for all participants. Given that the situation was natural and similar for all participants, individual differences likely accounted for their different responses. This is consistent with previous research showing that mindfulness training leads to reduced levels of both stress and depression (Goldin & Gross, 2010; Hindman, 2013; Shapiro, Brown, & Biegel, 2007; Shapiro, Brown, Thoresen, & Plante, 2011; Shapiro et al., 2008).

Strengths, Limitations, and Future Directions

One strength of the current study was the use of a well-validated experimental procedure for inducing stress – the Trier Social Stress Test. The biggest limitation of the current study was the small sample size. At the time of analysis, data had been collected for about 100 participants. A power analysis conducted before the start of the project indicated that a sample size of 160 was needed for sufficient power. Therefore, the small n is one possible explanation for the failure to detect a significant effect. Reasons for the small sample size were that this study was part of a larger project in which some participants underwent a different set of procedures unrelated to the current study goals. In addition, we only were able to collect the sample for two semesters. The study was continuing into this spring semester, until the University shut down due to the Corona 19 virus. Data are still being

collected, so hopefully a larger sample size can yield true effects if they exist.

Another limitation was the sample itself. All students were undergraduates at Vanderbilt University, 73% of whom were white or Asian. This demographic profile is not representative of the entire population, and thus, reduces the generalizability of the results. In addition, in a college student sample, there might not be sufficient variability on the measure of executive control. That is, students at Vanderbilt are generally highly intelligent and therefore might have shown a skewed distribution on executive functioning. Future research should use a more representative community sample that has more diversity in terms of race, age, and intelligence.

Also regarding measuring executive control, participants completed the measure twice, a week apart. The effect of the stress manipulation might not have been strong enough to overcome possible practice effects. Future studies should randomize participants to conditions that vary in the level of stress, and only administer the EC measure once. Moreover, without a way to validate the efficacy of the stress induction, we cannot be certain that it was sufficiently stressful. Conversely, it also is possible that the low stress control condition was stressful. In either case, potential differences between the two stress conditions would be reduced.

Future research should use different methodologies that maximize the effect of the stress induction task. With regard to the relation between mindfulness and depression, isolating the association of different facets of mindfulness with depressive symptoms would provide a better understanding of possible mechanisms that account for this relation. This is of particular importance because of how popular mindfulness has become as both a protective factor against and an intervention for reducing depression (Goldin & Gross, 2010; Hindman, 2013).

Overall, this study yielded few significant results. The relation between mindfulness and depression may not come through executive control as hypothesized, but a relation exists nonetheless. Moreover, the absence of significant results must be interpreted cautiously, particularly given the low power due to the small sample size. Considerable evidence exists in

the literature that mindfulness might prevent recurrence of subsequent depressive episodes and likely is a good method of intervention. Experimental studies that intervene using mindfulness methods to reduce the effects of stress are needed.

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Figure 1. Model of stress impairing executive control (Quinn, 2017)

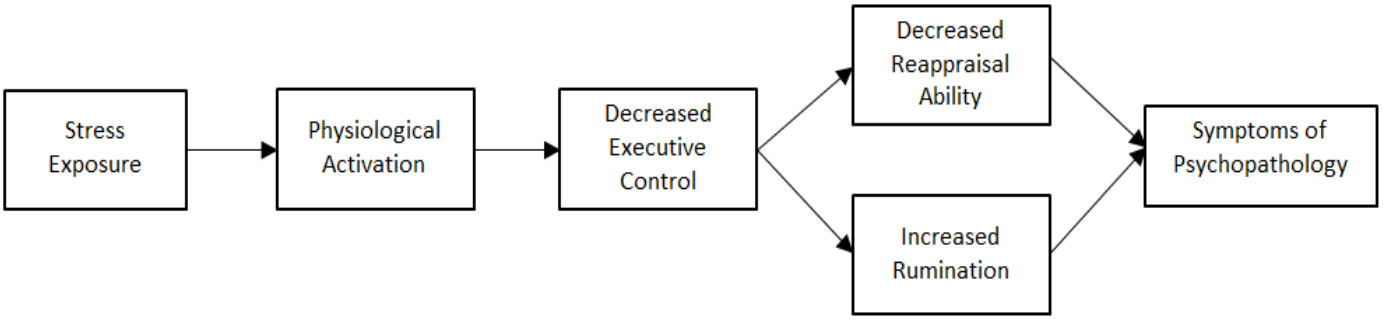
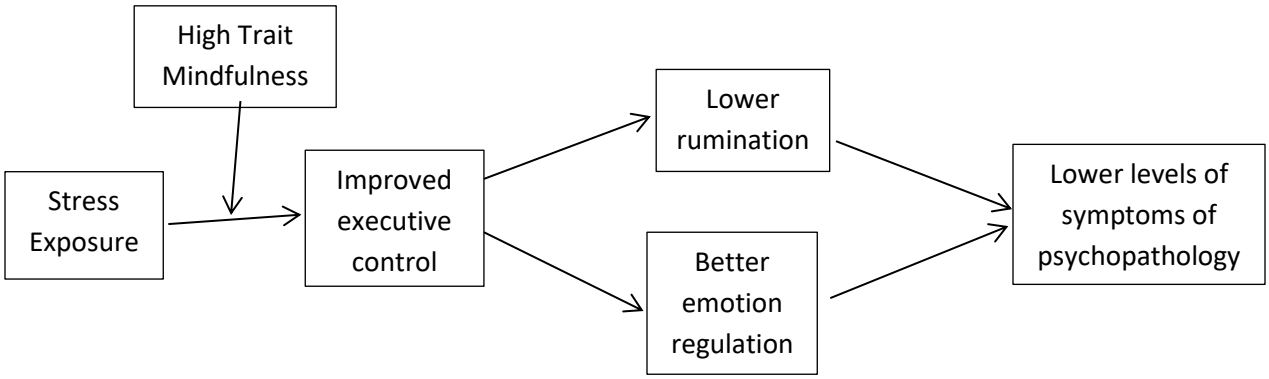


Figure 2. Model of how mindfulness may moderate the relation of stress and executive control.



Kentucky Inventory of Mindfulness Skills – Short

Directions: Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

1	2	3	4	5
Never or very rarely true	**Rarely true**	**Sometimes true**	**Often true**	**Very often or always true**

____1. I'm good at finding the words to describe my feelings.

____2. I criticize myself for having irrational or inappropriate emotions.

____3. When I'm doing something, I'm only focused on what I'm doing, nothing else.

____4. When I'm walking, I deliberately notice the sensations of my body moving.

____5. When I take a shower or bath, I stay alert to the sensations of water on my body.

____6. It's hard for me to find the words to describe what I'm thinking.

____7. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.

____8. I have trouble thinking of the right words to express how I feel about things.

____9. When I do things, I get totally wrapped up in them and don't think about anything else.

____10. I make judgments about whether my thoughts are good or bad.

____11. I pay attention to sensations, such as the wind in my hair or sun on my face.

____12. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.

____13. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.

____14. Even when I'm feeling terribly upset, I can find a way to put it into words.

____15. I tell myself that I shouldn't be thinking the way I'm thinking.

____16. I notice the smells and aromas of things.

____17. I tend to do several things at once rather than focusing on one thing at a time.

____18. I think some of my emotions are bad or inappropriate and I shouldn't feel them.

____19. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

____20. I get completely absorbed in what I'm doing, so that all my attention is focused on it.

* Items 2, 6, 7, 8, 10, 12, 15, 17, and 18 are reverse scored.

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