

2023

## A Brief Mindfulness Intervention and its Effect on Stress Response and Recovery: Rumination as a Moderator.

Kacie Peters  
*University of Kentucky*, [petersnkacie@gmail.com](mailto:petersnkacie@gmail.com)

Follow this and additional works at: [https://uknowledge.uky.edu/honors\\_theses](https://uknowledge.uky.edu/honors_theses)



Part of the [Applied Behavior Analysis Commons](#)

[Right click to open a feedback form in a new tab to let us know how this document benefits you.](#)

---

### Recommended Citation

Peters, Kacie, "A Brief Mindfulness Intervention and its Effect on Stress Response and Recovery: Rumination as a Moderator." (2023). *Lewis Honors College Thesis Collection*. 8.  
[https://uknowledge.uky.edu/honors\\_theses/8](https://uknowledge.uky.edu/honors_theses/8)

This Article is brought to you for free and open access by the Lewis Honors College at UKnowledge. It has been accepted for inclusion in Lewis Honors College Thesis Collection by an authorized administrator of UKnowledge. For more information, please contact [UKnowledge@lsv.uky.edu](mailto:UKnowledge@lsv.uky.edu).

UNIVERSITY OF KENTUCKY  
LEWIS HONORS COLLEGE

**A Brief Mindfulness Intervention and its Effect on Stress Response  
and Recovery: Rumination as a Moderator.**

by

**Peters, Kacie N.**

AN UNDERGRADUATE THESIS SUBMITTED  
IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DISTINCTION OF UNIVERSITY HONORS

Approved by the following:

Dr. Kate Leger  
Faculty Advisor and Assistant Professor

LEXINGTON, KENTUCKY  
May 2023



## **A Brief Mindfulness Intervention and its Effect on Stress Response and Recovery:**

### **Rumination as a Moderator.**

It is inevitable that every human will encounter many stressors in their life, so research on this topic is generalizable to many and carries a heavy weight. While facing one small stressor may not be enough to have a significant impact, it is the degree of the stressors and the response to them that can dictate whether or not it leads to serious consequences (WHO). Stress can be characterized as a stressor or combined stressors that lead to physical, emotional, and mental strain (WHO). It is important that we know the ways in which to best recover from stress, otherwise it could lead to more severe negative health outcomes (Lease et al., 2019). There are different ways to implement stress recovery that can be beneficial. Mindfulness has been shown to be effective in emotional recovery from negative affect (Crosswell et al., 2017). More research is needed on how certain traits interact with the certain ways of recovering from stress. For example, how might rumination play a role in the effectiveness of mindfulness in times of stress? Some people have higher tendencies to ruminate, and high trait rumination has been linked to prolonged negative affect (NA) which prolongs the stress response (Key et al., 2008). In the current study, we examined the role of a brief mindfulness intervention on affective and physiological recovery from a stressful task. Additionally, we examined if trait rumination moderated the associations between mindfulness and stress recovery.

### **Stress and Process of Recovery**

It is important to know how stressors elicit certain responses, in terms of both emotional and cardiovascular components, and to examine how recovery occurs in both aspects. Stress can cause difficulties in everyday behavior (e.g., eating well, socializing, and completing tasks), especially if there is no healthy recovery (Lease et al., 2019), and this can develop into more

severe physical and mental health outcomes such as heart disease, anxiety and depression, as well as inspire secondary health behaviors (e.g., smoking and drinking) that also have direct impacts on well-being (Lease et al., 2019). When referencing emotional components to stress response and recovery, the primary concern is affect or mood states. Affect refers to certain mood states or emotions and how an individual expresses it (APA). There is particular interest in negative affect and high-arousal negative affect. High arousal affect is referring to the amount in which the affective states activate the body (Mak & Schneider, 2022). How an individual responds to a stressful event influences their regulation of their emotional states and how much they experience NA and high-arousal NA (Kessler & Staudinger, 2009). It is specifically important to research high-arousal NA because the emotions linked with it, such as feeling stressed, angry, and tense, tend to be higher in the presence of a stressful situation (Mak & Schneider, 2022).

Another component of stress recovery relates to the cardiovascular system, involving measures such as heart rate and blood pressure (BP). Cardiovascular reactivity relates to changes that occur as a response to a stressor that involves the heart or blood vessels (Key et al. 2008). Blood pressure is a known physiological response mechanism to stressful situations (Key et al., 2008). When a stressful event causes blood pressure to change and other parts of the system to react, there must then be recovery following the stressful event. Cardiovascular recovery is the process in which the physiological systems are returned to their baseline levels (Key et al., 2008).

Research has supported that there is a link between negative affect and cardiovascular stress reactions, which is then associated with slower cardiovascular recovery (Radstaak et al., 2011). Prior research has looked at the differences between emotional and cardiovascular

recovery when experiencing a stressful event and explained that the relation between NA and cardiovascular responses during stressors, like public speaking, involves being immersed in a stressful environment where one experiences negative emotional states, causing bodily and physiological reactions (Waugh et al., 2010).

### **Mindfulness as a Tactic**

Mindfulness and the practice of meditation is a widely known topic in the field of psychology and well-being. While mindfulness can be described as a state of mind, it can also be described as a practice. It is the practice of continually bringing attention to the present moment and what is happening internally and externally for an individual (Deyo et al., 2009). Mindfulness involves “observing thoughts and feelings as temporary cognitive events, and taking a non-judging, accepting stance to those events” (Kaiser et al., 2015). This can be directly applied to the presence of stressful events where the person is able to think objectively about the situation at hand. Being mindful consists of “paying attention in a particular way” purposefully and nonjudgmentally in the present moment, and it is a tactic that is thought to reduce stress and increase well-being (Crosswell et al., 2017). If those experiencing stress are not recovering, this could lead to prolonged, more extreme effects (Lease et al., 2019).

Mindfulness is said to aid stress recovery because it involves mastery of an experience that builds new resources (van Hooff & Baas, 2013). A study by van Son and researchers (2013) observed significant effects on emotional well-being after a mindfulness intervention on diabetic patients who were experiencing a lot of distress. They saw significant decreases in perceived stress and significant improvements in the patients’ quality of life (van Son et al., 2013).

### **Rumination as a Moderator**

Some traits in an individual can affect the amount to which stress prevails, such as rumination. Rumination is defined as the process of mentally repeating negative thoughts and emotions in a way that is related to content of the mind (Deyo et al., 2009). Nolen-Hoeksema's response styles theory describes rumination as a way of responding to stressful events, and it is "predictive of the onset of depressive symptoms" (Nolen-Hoeksema et al., 2008; Layous et al., 2022). Rumination has been shown to be linked to stress outcomes related to cardiovascular reactivity as well as emotion and mood states. Results from a study by Key and researchers (2008) suggests that rumination impacts the link between stress and high blood pressure because rumination negatively affects cardiovascular reactivity following a stressor by prolonging the duration of the reaction after experiencing stress. Rumination has also been found to increase negative affect (McLaughlin et al., 2007). In other words, this thinking process is linked with experiencing negative mood states, even for individuals who do not experience anxiety and depression (McLaughlin et al., 2007).

Past research has also looked at the impact of rumination on the mindfulness and stress recovery relationship. Their results show a relationship between mindfulness and trait rumination, finding an increase in high trait ruminators' mindfulness after a 4-week mindfulness-based therapy intervention while seeing no improvements for low trait ruminators (Frostadittir & Dorjee, 2019). Based on literature linking mindfulness and stress recovery (van Son et al., 2013; van Hooff & Baas, 2013) and these results (Frostadittir & Dorjee, 2019), we can extrapolate that high trait ruminators will have better stress recovery if they are engaging in mindfulness.

### *Current Study*

In this present study, we sampled college students at a large university, and we had each participant complete a stress task called the Trier Social Stress Test (TSST; Kirschbaum, 1993).

The TSST was followed by either 5 minutes of a mindfulness meditation audio or a control condition with 5 minutes of resting. The study measured for emotional states and BP at baseline, during TSST, and during recovery. Trait rumination was measured during baseline.

First, we hypothesized that the participants in the mindfulness condition would show greater stress recovery (i.e., less negative affect and blood pressure reactivity) than those in the control condition. Secondly, we hypothesized that those who scored high in trait rumination would show less stress recovery (i.e., greater negative affect and blood pressure reactivity) after the task. Lastly, we hypothesized that those who scored high in trait rumination would show better stress recovery after the mindfulness condition than the control condition, compared to those who scored low in trait rumination.

## Methods

### Participants

Participants ( $N=155$ ; age range 18-36,  $M=19.07$ ,  $SD=2.079$ ) were undergraduate students who were recruited through SONA, a subject pool used by the university. The sample consisted of 72% female participants and 64% were White, 15% were Black/African American, and 6.5% were Asian. For compensation, participants earned credit towards their introductory psychology course. Participants were considered ineligible for the study if they were taking any mood-altering medications or were diagnosed with any clinical mental disorders. Data collected from our sample was approved by the University of Kentucky's Institutional Review Board, and data collection started November 4, 2019, and ended April 21, 2022.

### Procedure

Overall, this was part of a larger study consisting of three conditions (mindfulness, positive feedback, and control), but for our hypotheses, we are only looking at the mindfulness and control condition. The participants were expected to complete the study in the laboratory in approximately an hour. Participants read and signed an informed consent document prior to participating. A researcher placed electrodes on their core and back as well as placing a blood pressure cuff on their non-dominant arm. The participant completed a set of baseline questionnaires in which questions about trait rumination, emotional states and other baseline questions were asked.

After baseline questionnaires, the TSST was implemented. Participants were told by sternly composed researchers that they had two minutes to prepare a 5-minute speech that explained why they would be a good candidate for their ideal job. The researchers acted cold and did not answer any questions that were asked, other than repeating parts of the task instructions



over again. They then had to present that speech in front of the researchers who acted as stern evaluators in a panel. The researcher would provide feedback every 45 seconds, interrupting the participant, and giving comments such as “Please speak louder” or “Remain focused on the task at hand”.

After the TSST stress task, the researchers left the room and the participant had to fill out more questionnaires asking about emotional states and how they felt about the task. Following, in the recovery period, participants were instructed to either sit quietly for 5 minutes or listen to a 5-minute mindfulness audio and follow the instructions. After the recovery period, the study ended with the final set of questionnaires asking about the task post-recovery, emotional states a third time, and some basic demographic questions. The participants were then debriefed and thanked.

## **Measures**

### ***Stress Response and Recovery***

Participants were asked to rate their current feelings in relation to common emotional states using the Profile of Mood States (McNair, 1971) which stated 13 different negative emotional states (e.g., stressed, unhappy, bored, anxious, irritable, angry, embarrassed, sad, tired, frustrated). Participants had to choose the number that described how they felt in the present moment in relation to that emotion; the scale ranged from 1 (*not at all*) to 5 (*extremely*). From here, negative emotions were further broken down into a high arousal negative emotion category. The negative high arousal emotions consisted of eight emotions that contributed to high arousal: stressed, irritable, angry, embarrassed, nervous, frustrated, overwhelmed, and anxious. An example of a negative emotion that is not high arousal would be sad or tired (Mak & Schneider, 2022). The Profile of Mood States has shown to be internally reliable with a coefficient alpha

from 0.89 to 0.95 (Albani et al., 2005). These two measures allowed us to compute negative affect of each participant. We compared their negative affect levels from their recovery period to their levels at baseline, giving us their recovery score.

In addition to negative affect, we measured stress response and recovery by taking the participants' systolic and diastolic blood pressure. We administered a blood pressure cuff at the start of the study and measured each participants' blood pressure at baseline of the study, during the TSST prep, during the TSST speech task, and during recovery. We compared blood pressure during recovery to their baseline blood pressure as a separate measure to operationalize stress response and recovery.

### ***Trait Rumination***

The Rumination-Reflection Scale was administered at baseline to participants to assess their trait rumination. Participants were asked 12 questions concerning their rumination level. On this scale, the participant was asked to answer on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Questions asked included "I often find myself reevaluating something I've done." and "Sometimes it is hard for me to shut off thoughts about myself". A composite score was calculated for each participant. The higher their composite score, the higher they ruminated. Previous research has found the Rumination-Reflection Scale to be reliable with a coefficient alpha of 0.90 for the rumination subset (Harrington & Loffredo, 2010).

### ***Mindfulness Intervention***

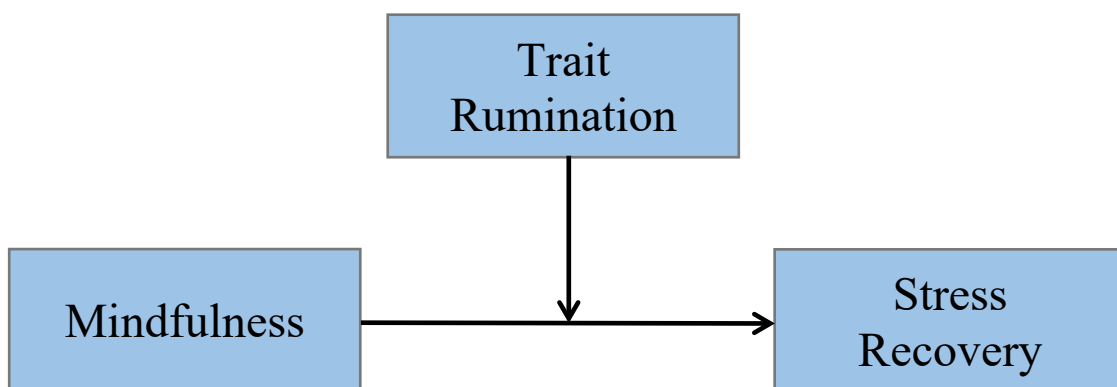
If the participant was assigned to the mindfulness condition, we introduced a 5-minute audio file at the beginning of the recovery period. Participants were instructed to sit quietly and follow along with the mindfulness audio that was playing. The researcher turned off the computer monitor screen so that full attention was on the audio and left the room until it was

finished. Parts of the audio included phrases such as “Take a few deep breaths. While you are breathing deeply, relax your shoulders... release all the tension in your body” and “Focus on the sensation of your breath in the foreground, allow thoughts and feelings to come and go in the background”. Participants were told to close their eyes and sit as still as possible.

### Planned Analyses

First, descriptive statistics and bivariate correlations were conducted, as well as checking for outliers. To test our first hypothesis, linear regressions were conducted with mindfulness vs. control predicting stress recovery (i.e., blood pressure, negative affect and high arousal negative affect). To test our second hypothesis, linear regressions were conducted with rumination predicting stress recovery. Lastly, to test our third hypothesis looking at the moderating effect of rumination on the relationship between the experimental condition and stress recovery (Figure 1), the interaction term of rumination and mindfulness vs. control were included in the model to predict stress recovery. All models were adjusted for age, gender, and race.

*Figure 1*



Specifically, in our hypotheses, we expect to see mindfulness and trait rumination impact stress recovery in both emotional and physiological components. Our specific hypotheses

include: (1) the mindfulness condition would lead to better recovery scores (i.e., the participant's level of recovery returned close to their baseline level) for negative affect, high-arousal negative affect, and blood pressure compared to the control condition, and (2) high trait rumination would lead to worse stress recovery scores (i.e., the participant's level of recovery did not return close to their baseline level) for negative affect, high-arousal negative affect, and blood pressure. Additionally, we hypothesized about the moderating relationship of rumination on mindfulness and stress recovery: high trait ruminators in the mindfulness condition would show greater stress recovery scores in all aspects (i.e., NA, high-arousal NA, and blood pressure) compared to high trait ruminators in the control condition.

## Results

### *Descriptive Statistics*

Participants ( $N=155$ ) were undergraduate psychology students from the University of Kentucky recruited from the SONA subject pool. The sample consisted of 72% female participants and 64% were White, 15% were Black/African American, and 6.5% were Asian. Data collected from our sample was approved by the University of Kentucky's Institutional Review Board. Correlations were run between mindfulness, trait rumination, the interaction between mindfulness and rumination, negative affect, high-arousal negative affect, systolic blood pressure, diastolic blood pressure, gender, race, and age (*See Table 1*). For trait rumination, we saw a significant difference between males and females ( $t = 2.26, p < .05$ ). This indicates that women were more likely to ruminate than men.

### **Table 1**

#### *Descriptive Statistics and Correlations among Variables*

	M/%	SD	1	2	3	4	5	6	7	8	9	10
1. Mindfulness (ref=Control)	.52	.50	-	-0.15	-0.14	<i>-0.18</i>	-0.19	0.05	-0.08	0.10	0.15	-0.14
2. Trait Rumination	-0.03	.77		-	<b>0.70</b>	<b>0.22</b>	0.20	0.12	-0.02	<i>-0.18</i>	0.04	-0.09
3. Rumination/ Mindfulness Interaction	-0.07	.53			-	<b>0.25</b>	<i>0.20</i>	0.15	0.04	<b>-0.23</b>	0.15	0.05
4. Negative Affect	.01	.98				-	<b>0.93</b>	-0.09	0.07	-0.16	0.08	-0.16
5. High-Arousal Negative Affect	-0.0003	.97					-	-0.09	0.11	-0.15	0.09	-0.13
6. Systolic BP	-0.11	.88						-	<b>0.29</b>	0.12	-0.06	-0.05
7. Diastolic BP	-0.12	.95							-	-0.05	-0.14	0.03
8. Gender (ref=Female)	26%									-	-0.09	<i>0.18</i>
9. Race (ref=Non-White)	35%										-	0.11
10. Age	19.07	2.08										-

Note. Significant values in italics are significant at the  $p < .05$  level, Significant values in bold are significant at the  $p < .01$  level, Significant values in bold and italics are significant at the  $p < .001$  level.

*Mindfulness and Stress Recovery*

To test our hypothesis of whether mindfulness would significantly decrease stress responses, meaning better stress recovery, a multiple regression model was used with the standardized residuals method. All of our models were controlled for gender, race, and age. Consistent with the primary hypothesis, mindfulness showed overall better stress recovery by having lower negative affect at recovery compared to baseline ( $b=-.37$ , 95% CI [-.69, -.05]). For those that were in the mindfulness condition, their negative affect was less than those in the control condition after recovery. Also consistent with our primary hypothesis, mindfulness showed overall better stress recovery by having lower high-arousal negative affect at recovery from baseline ( $b=-.40$ , 95% CI [-.72, -.09]). For those in the mindfulness condition, their high arousal negative affect was less than those in the control condition after recovery. While negative affect and high-arousal negative affect were significantly better recovered for the mindfulness condition vs. control condition, there was no significant difference ( $p > .05$ ) of systolic, diastolic, and MAP blood pressure between conditions.

**Table 2**

*Regression results using negative affect as criterion*

Predictor	b	b 95% CI [LL,UL]	beta	t	Sig.
(Constant)	1.47	[.01, 2.93]		1.99	.049
Mindfulness	-.37*	[-.69,-.48]	-.19	-2.27	.025

### ***Rumination and Stress Recovery***

To test our hypothesis of whether trait rumination would significantly increase stress responses, meaning worse stress recovery, a multiple regression model was used with the standardized residuals method. All of our models were controlled for gender, race, and age. Consistent with the second hypothesis, trait rumination showed overall worse stress recovery by

having higher negative affect at recovery compared to baseline ( $b=.23$ , 95% CI [.04, .41]). This indicates that there was a significant difference for stress recovery for negative affect based on an individual's trait rumination level. The greater someone's trait rumination score was, the greater their negative affect was after recovery. While negative affect showed a significant difference between low trait ruminators and high trait ruminators, there was no significant difference ( $p > .05$ ) for stress recovery for high-arousal negative affect, systolic, diastolic, and MAP blood pressure based on an individual's trait rumination level.

**Table 3**

*Regression results using negative affect as criterion.*

Predictor	b	b 95% CI [LL,UL]	beta	t	Sig.
(Constant)	.98	[-.32, 2.28]		1.48	.140
Trait Rumination	.23*	[.04, .41]	.17	2.44	.016

### ***Mindfulness, Rumination, and Stress Recovery***

To test our hypothesis of whether the relationship between mindfulness and stress recovery was moderated by trait rumination, a multiple regression model was used with the standardized residuals method that included this interaction. All of our models were controlled for gender, race, and age. We hypothesized that mindfulness would lead to higher stress recovery for high trait ruminators than low trait ruminators. Inconsistent with our third hypothesis, there was no significance in stress recovery for negative affect, high-arousal negative affect, or systolic, diastolic, or MAP blood pressure for our interaction term ( $p > .05$ ).

## **Discussion**

This study aimed to examine the relationship between mindfulness and stress recovery, rumination and stress recovery, and how rumination affects the relationship between mindfulness and stress recovery. Our study found that the brief mindfulness intervention led to significantly better stress recovery (i.e., lower negative affect after recovery) which is consistent with previous studies that support mindfulness as a tactic for dealing with stressful situations (Crosswell et al., 2017; van Son et al., 2013). When looking at the relationship, only negative affect and high-arousal negative affect showed significantly better recovery after the mindfulness intervention. This could suggest that the specific 5-minute audio used was sufficient at relieving negative emotional states, but the physiological, bodily stress responses were slower at returning back to their baseline state.

Our study also found that the higher an individual's trait rumination level was led to significantly worse stress recovery. This is consistent with studies that link rumination with having poorer stress recovery (Key et al., 2008; Manigault et al., 2021; García et al., 2017). When looking at this relationship, there was only a significantly worse recovery when looking at negative affect, comparing high-trait ruminators to low-trait ruminators. This could suggest that individuals who have a tendency to repeat negative thoughts over and over are significantly altering their mood and emotional states, yet there is not much change with physiological stress responses, such as blood pressure.

Looking at the study by Frostadittir and Dorjee (2019), they found that the Mindfulness Based Cognitive Therapy enhanced mindfulness for those who were initially high in rumination, and those with low rumination did not show improvements. Based on this, we hypothesized that because of this link in mindfulness and rumination, that those high in trait rumination would show even better stress recovery after using mindfulness than low trait ruminators. Contrary to



this finding and our extrapolation, we did not find any significant interaction when looking at rumination as a moderator in this relationship. This could suggest that our mindfulness intervention did not particularly target negative thoughts, as it was a brief, beginner level version of a mindfulness meditation.

### **Strengths and Limitations**

By doing this study, we increase support behind using mindfulness as a tactic for healthily recovering from stress. It provides a unique insight because of the brief nature of the study and the mindfulness intervention. The TSST allowed for a controlled stress response and recovery process, followed by the implementation of mindfulness or resting. It showed the significance that mindfulness can have even in small increments, which has not been heavily studied previously.

The mindfulness audio used could also be seen as a limitation, as it likely was too short to give a comprehensive, thorough experience of mindfulness meditation specifically for rumination. It lacked focus on negative thoughts and focused on being in the present moment and paying attention to the breath.

The sample also provides some limitations to the study. Since the sample was pooled within a university's psychology course, it consists of only college students that were primarily White (65%) and female (74%). This limits generalizability of the study's results. Additionally, based on post-hoc power analyses with calculating the true effect size found in this study, there was enough power for negative affect and high-arousal negative affect that had larger effect sizes based on the correlations, but there wasn't enough power to find significant differences for the blood pressure variables that had smaller effect sizes.

### **Future Directions and Conclusions**

In future studies, they should examine the impact of a brief mindfulness intervention on a more diverse sample, differing in race, gender, and age, so that it can lead to more generalizability and support mindfulness for many groups of people. Future mindfulness research should continue to examine the moderation of rumination, whether it is trait-rumination or state-rumination. While we wanted to see a link between trait rumination and the effectiveness of mindfulness on stress recovery, it would be interesting to see more research on whether high trait ruminators are more likely to be mindful overall (Frostadittir & Dorjee, 2019). There continues to be growing support of mindfulness as practice and way of thinking that leads to healthy stress recovery. This study has further corroborated what is known about mindfulness and added to the research on trait rumination as well.

### References

- Albani, C., Blaser, G., Geyer, M., Schmutzer, G., Brähler, E., Bailer, H., & Grulke, N. (2005). Überprüfung der Gütekriterien der deutschen Kurzform des Fragebogens "Profile of Mood States" (POMS) in einer repräsentativen Bevölkerungsstichprobe [The German short version of "Profile of Mood States" (POMS): psychometric evaluation in a representative sample]. *Psychotherapie, Psychosomatik, medizinische Psychologie*, 55(7), 324–330. <https://doi.org/10.1055/s-2004-834727>
- American Psychological Association. (n.d.). *APA Dictionary of Psychology*. American Psychological Association. Retrieved November 9, 2022, from <https://dictionary.apa.org/affect>
- Crosswell, Moreno, P. I., Raposa, E. B., Motivala, S. J., Stanton, A. L., Ganz, P. A., & Bower, J. E. (2017). Effects of mindfulness training on emotional and physiologic recovery from induced negative affect. *Psychoneuroendocrinology*, 86, 78–86. <https://doi.org/10.1016/j.psyneuen.2017.08.003>
- Deyo, M., Wilson, K. A., Ong, J., & Koopman, C. (2009). Mindfulness and rumination: Does mindfulness training lead to reductions in the ruminative thinking associated with depression? *EXPLORE*, 5(5), 265–271. <https://doi.org/10.1016/j.explore.2009.06.005>
- Frostadittir, & Dorjee, D. (2019). Effects of Mindfulness Based Cognitive Therapy (MBCT) and Compassion Focused Therapy (CFT) on Symptom Change, Mindfulness, Self-Compassion, and Rumination in Clients With Depression, Anxiety, and Stress. *Frontiers in Psychology*, 10, 1099–1099. <https://doi.org/10.3389/fpsyg.2019.01099>
- García, F. E. , Duque, A. & Cova, F. (2017). The Four Faces of Rumination to Stressful

- Events. *Psychological Trauma: Theory, Research, Practice, and Policy*, 9 (6), 758-765. doi: 10.1037/tra0000289.
- Harrington, & Loffredo, D. A. (2010). Insight, Rumination, and Self-Reflection as Predictors of Well-Being. *The Journal of Psychology*, 145(1), 39–57.  
<https://doi.org/10.1080/00223980.2010.528072>
- Kaiser, Andrews-Hanna, J. R., Metcalf, C. A., & Dimidjian, S. (2015). Dwell or Decenter? Rumination and Decentering Predict Working Memory Updating After Interpersonal Criticism. *Cognitive Therapy and Research*, 39(6), 744–753.  
<https://doi.org/10.1007/s10608-015-9697-1>
- Kessler, & Staudinger, U. M. (2009). Affective Experience in Adulthood and Old Age: The Role of Affective Arousal and Perceived Affect Regulation. *Psychology and Aging*, 24(2), 349–362. <https://doi.org/10.1037/a0015352>
- Key, B.L., Campbell, T.S., Bacon, S.L. *et al.* The influence of trait and state rumination on cardiovascular recovery from a negative emotional stressor. *J Behav Med* 31, 237–248 (2008). <https://doi.org/10.1007/s10865-008-9152-9>
- Kirschbaum, C., Pirke, K. M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test'--a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, 28(1-2), 76–81. <https://doi.org/10.1159/000119004>
- Lease, Ingram, C. L., & Brown, E. L. (2019). Stress and Health Outcomes: Do Meaningful Work and Physical Activity Help? *Journal of Career Development*, 46(3), 251–264.  
<https://doi.org/10.1177/0894845317741370>
- Layous, K., Kumar, S. A., Arendtson, M., & Najera, A. (2022). The effects of rumination,

- distraction, and gratitude on positive and negative affect. *Journal of Personality and Social Psychology*. Advance online publication. <https://doi.org/10.1037/pspp0000440>
- Mak, & Schneider, S. (2022). High- and Low-Arousal Daily Affect Dynamics Vary Across the Adult Lifespan. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 77(5), 895–904. <https://doi.org/10.1093/geronb/gbab203>
- Manigault, A. W. , Shorey, R. C. , Decastro, G. , Appelman, H. M. , Hamilton, K. R. , Scanlin, M. C. , France, C. R. & Zoccola, P. M. (2021). Standardized Stress Reduction Interventions and Blood Pressure Habituation. *Health Psychology*, 40 (3), 196-206. doi: 10.1037/hea0000954.
- McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy*, 38(1), 23-38.
- McNair D. M. Lorr M. Droppleman L. F. & Educational and Industrial Testing Service. (1971). *Profile of mood states*. Educational and Industrial Testing Service.
- Nolen-Hoeksema, Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science*, 3(5), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>
- Radstaak, Geurts, S. A. E., Brosschot, J. F., Cillessen, A. H. N., & Kompier, M. A. J. (2011). The role of affect and rumination in cardiovascular recovery from stress. *International Journal of Psychophysiology*, 81(3), 237–244. <https://doi.org/10.1016/j.ijpsycho.2011.06.017>
- van Hooff, & Baas, M. (2013). Recovering by means of mediation: the role of recovery experiences and intrinsic motivation. *Applied Psychology*, 62(2), 185–210.
- van Son, J., Nyklíček, I., Pop, V. J., Blonk, M. C., Erdtsieck, R. J., Spooren, P. F., Toorians, A.

W., & Pouwer, F. (2013). The effects of a mindfulness-based intervention on emotional distress, quality of life, and HbA(1c) in outpatients with diabetes (DiaMind): a randomized controlled trial. *Diabetes care*, *36*(4), 823–830. <https://doi.org/10.2337/dc12-1477>

Waugh, C. E., Panage, S., Mendes, W. B., & Gotlib, I. H. (2010). Cardiovascular and affective recovery from anticipatory threat. *Biological psychology*, *84*(2), 169-175.

World Health Organization. (n.d.). *Stress*. World Health Organization. Retrieved November 9, 2022, from <https://www.who.int/news-room/questions-and-answers/item/stress>