Mind your pressure: A study on the effect of trait mindfulness on resting blood pressure

by

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Abstract

Higher elevations in resting blood pressure in normotensive individuals has been correlated to a psychophysiological phenomenon known as *cardiovascular emotional dampening*, which is characterized by reduced emotional response, pain analgesia, and increased risk-taking behavior. Additionally, recent research has correlated cardiovascular emotional dampening to hypertension and have found that the lack of emotional response to stressors can develop a positive feedback loop which may lead to hypertension. *Trait mindfulness* is a concept correlated to emotion regulation, self-awareness, and metacognition. This study aimed to evaluate trait mindfulness and elevations in resting blood pressure in a sample of 86 normotensive college students. Results revealed that there is potential for a negative correlational relationship between the describing facet of trait mindfulness and resting systolic blood pressure, but there was no definitive significance following a simultaneous multiple regression. As resting blood pressure was not a unique predictor of trait mindfulness, the findings of the present study imply that emotional dampening phenomenon might have a limited impact on our ability to be mindful. The implication of which for the prevention of hypertension and heart disease are discussed.

Keywords: Cardiovascular Emotional Dampening, Hypertension, Resting Blood Pressure, Alexithymia, TAS-20, Trait Mindfulness, FFMQ

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List of Abbreviations

ACTH	Adrenocorticotropic hormone
ANS	Autonomic Nervous System
CNS	Central Nervous System
CRH	Corticotrophin-releasing hormone
DBP	Diastolic Blood Pressure
FFMQ	Five Facet Mindfulness Questionnaire
HPA	Hypothalamic-pituitary-adrenocortical
MBSR	Mindfulness-based Stress Reduction
ParaNS	Parasympathetic Nervous System
PNS	Peripheral Nervous System
SAM	Sympatho-adreno-medullary
SBP	Systolic Blood Pressure
SNS	Somatic Nervous System
SymNS	Sympathetic Nervous System
TAS-20	Toronto Alexithymia Scale-20

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Cardiovascular diseases are the number one cause of death in the United States (Nardi et al., 2020). There are multiple causes for this issue, such as high cholesterol, obesity, hypertension (also known as high blood pressure), etc. (CDC, 2020). Fortunately, there are various medical solutions to this problem, such as dieting, exercising, prescription medications, etc. (CDC, 2019). However, cardiovascular issues such as hypertension have risk factors related to lifestyle. Stress is one risk factor that can manifest physically and mentally (Korner, 2007). As stress increases, the risk of hypertension may increase due to stress increasing the effect of it developing (Kulkarni et al., 1998). However, there are multiple methods to reducing stress levels in individuals. Stress-reduction methods include exercise, sleep, psychotherapy, and mindfulness (Piotrowski, 2020). All in all, by altering lifestyle factors such as excessive stress, one's risk of developing cardiovascular diseases like hypertension may decrease following one or more interventions or lifestyle changes.

The Physiology of Stress

Stress is prominent within American society, notably stress resulting from job strain, emotional distress, money issues, environmental and social issues, etc. (Kulkarni et al., 1998). This indicates that stress should be considered when observing causes for hypertension in the general population, but before observing the relation between stress and hypertension, an explanation of the physiology of stress is important.

Both of the body's nervous systems, the Central Nervous System (CNS) and the Peripheral Nervous System (PNS) are main functions in the body's response to stress, but the CNS is central to the body's stress response because it is responsible for stress regulation overall (Tsigos et al., 2000). The PNS breaks down into two branching systems, the Autonomic Nervous System (ANS) and the Somatic Nervous System (SNS). The ANS then divides into two more systems, the Sympathetic Nervous System (SymNS) and the Parasympathetic Nervous System (ParaNS). The ANS is home to one of the most well-known physical reactions to stress, the "fight or flight" response. This response is a result of the synaptic nervous system and endocrine system preparing the body for an incoming threat (Romero, 2019).

When the stress response is activated, one of the first parts of the process is the sympatho-adreno-medullary (SAM, a.k.a. sympathetic-adrenomedullary) axis. This axis is activated by the hypothalamus and is responsible for the "fight or flight" response. In essence, the SAM axis stimulates the medulla to secrete epinephrine and norepinephrine (Kudielka & Kirschbaum, 2001). The second part of the body's stress response involves the hypothalamic-pituitary-adrenocortical (HPA, a.k.a. hypothalamic-pituitary-adrenal) axis. The HPA axis consists of the hypothalamus, the pituitary glands, and the adrenal glands, and the process works its way down through each organ. First, the hypothalamus is activated in response to stress, and its reaction is discharging corticotrophin-releasing hormone (CRH) (Tsigos et al., 2000). The CRH activates the pituitary gland to produce adrenocorticotropic hormone (ACTH), then the ACTH stimulates the adrenal cortex to activate the secretion of corticosteroids (Tsigos et al., 2000). Corticosteroids are steroid hormones that originate from the adrenal cortex and help regulate inflammation, homeostasis, and other bodily functions (Ramamoorthy & Cidlowski, 2016). One notable corticosteroid is cortisol, an important hormone in the body's response to stress. It is a physiological response to stress that is sensitive to psychological factors (Ramamoorthy & Cidlowski, 2016). An excess of cortisol can lead to negative effects such as hypertension and a weakened immune system (Vianna et al., 2011). Essentially, prolonged stress leads to prolonged high cortisol levels which can lead to hypertension and other negative physiological effects.

Kulkarni et al. (1998) further explained how stress can cause hypertension, "Stress can cause hypertension through repeated blood pressure elevations as well as by stimulation of the nervous system to produce large amounts of vasoconstricting hormones that increase blood pressure." In essence, consistent stress can increase blood pressure repeatedly which can result in the development of hypertension. However, Kulkarni argues that stress cannot cause hypertension, because causation is difficult to prove, but it can affect its development (Kulkarni et al., 1998). On the other hand, Kulkarni's statement is outdated. As previously mentioned by Vianna et al. (2011), stress can cause hypertension through physiological means, specifically a prolonged excess of cortisol circulating in the body. In essence, reducing stress will reduce cortisol levels and will lead to a reduction in the chance of developing hypertension.

Mindfulness in Regards to Stress and Hypertension

Thankfully, there are solutions outside of medical intervention that may prevent children, teens, and young adults from developing hypertension later in life (American Psychological Association, 2011). Some examples of non-pharmaceutical interventions include meditation, music therapy, biofeedback, acupuncture, etc. (Kulkarni et al., 1998).

One solution for amending the adverse effects of stress on health is mindfulness meditation or the general practice of mindfulness (An et al., 2018). Mindfulness is being present in the moment and aware of one's thoughts and emotions without judgment (MacDonald & Price, 2017). Mindfulness can help an individual control stressors by being aware of their physical tensions and mental stressors and actively reducing their pressure. The regular practice of mindfulness is thought to be proactive in controlling health issues such as hypertension (Wright et al., 2020; Bhasin et al., 2018). Essentially, if excessive stress can lead to negative health consequences such as hypertension, then the goal is to lower the chances of negative health afflictions occurring in one's body. This goal could be achieved by reducing the stress levels in one's body, but there must be an applicable method to reduce stress. One potential method is Mindfulness-based Stress Reduction therapy. Mindfulness-based Stress Reduction (MBSR) is a form of therapy that focuses on using cognition, perception, and awareness in exercises to achieve a state of present moment awareness. The goal of MBSR is to utilize mindfulness to reduce stress. However, the consensus on MBSR is currently unconclusive. This may be due to mindfulness not being as thoroughly studied as other topics. It could also be due to participants differing in levels of trait mindfulness, but that is just a hypothetical limitation.

To elaborate, some individuals are more prone to engaging in mindfulness than others due to trait mindfulness. Trait mindfulness is described by Carpenter et al. (2019) as, " … an individual's characteristic tendency to maintain awareness of the present moment in a nonreactive and nonjudgmental manner," (pg. 1). Trait mindfulness allows an individual to consistently maintain present moment awareness without reacting to or judging external or internal factors, thus achieving state mindfulness more often. As individuals practice mindfulness, they build up their trait mindfulness (Carpenter et al., 2019). Trait mindfulness differs from state mindfulness because state mindfulness is a nonjudgmental awareness of the present moment that can occur at any given moment (Carpenter et al., 2019). Furthermore, trait mindfulness, or dispositional mindfulness as described in An et al. (2018), can help control daily stressors (An et al., 2018). Trait mindfulness may be a factor in reducing stress in an individual and subsequentially reducing the risk of hypertension. Furthermore, there are particular types of individuals who would be at risk for developing hypertension.

Background on Hypertension and Cardiovascular Emotional Dampening

Stereotypically, one might imagine a stressed individual with hypertension as a someone with a “Type A” personality, as in they are highly emotional and may respond aggressively to stressors. However, there is another “type” of individual who is at risk, specifically those who are not emotionally responsive to stressors, and they are on the opposite end of the Type A personality. With respect to the etiology of hypertension, recent research has tied chronic and sustained elevations in resting blood pressure to several different psychophysiological phenomena, including increased pain analgesia (Bruehl & Chung, 2004; McCubbin et al., 2006), reduced emotional responsivity (Delgado et al., 2014; Pury et al., 2004), and increased risk-taking behavior (McCubbin et al., 2018; Loveless et al., 2018). Collectively, this phenomenon has been dubbed cardiovascular emotional dampening and has been observed in both normotensive and hypertensive samples (McCubbin et al., 2014; McCubbin et al., 2011). It is thought to contribute to the development of hypertension via a positive feedback loop wherein a dampened emotional response to environmental demands prevents effective adaptation, thus, increasing allostatic load and further elevating resting blood pressure (McCubbin et al., 2018). In other words, the more an individual's body responses to the stressor and they do not cognitively perceive their stress levels leads to the body compensating by responding physiologically which leads to a positive feedback loop which worsens cardiovascular functioning. These findings acknowledge that not only are highly emotional individuals at risk for developing hypertension and/or other cardiovascular diseases, but those who have a lack of emotional awareness may also be at risk for developing these afflictions.

Additionally, previous research has distinguished the cardiovascular emotional dampening phenomenon from other related constructs such as alexithymia, trait defensiveness, and state anxiety (McCubbin et al., 2014), but no research has yet been conducted to determine how it might be related to trait mindfulness. The population of those who have cardiovascular emotional dampening has yet to be studied in relation to trait mindfulness. To explore the relationship between cardiovascular emotional dampening and trait mindfulness, then the existence of a relationship between resting blood pressure and trait mindfulness must be established first.

Statement of the Study

The goal of this research was to determine if there is a relationship between trait mindfulness and resting blood pressure among a sample of healthy, normotensive college students. Consistent with the literature mentioned above, it was expected that college students with increased resting blood pressures will have lower trait mindfulness scores. Covariates such as alexithymia and sex will be controlled to observe the unique relationship between mindfulness and resting blood pressure.

Methods

Participants

A sample of 90 undergraduate student participants were recruited from the MTSU psychology department's participant pool via the SONA system for MTSU. An a priori power analysis using GPower (Faul, Erdfelder, Buchner, & Lang, 2009) indicated that a sample size of 80 participants would yield sufficient power to find medium to small effects in the primary analyses of the study. Prospective participants were screened before signing consent to determine their eligibility. To meet eligibility, all participants met the following requirements: (1) must be the age of 18 or older, (2) must be enrolled at Middle Tennessee State University, where the study took place, (3) must be able to meet in person to participate in the study, and (4) must meet the health requirements. The health requirements included (1) no usage of nicotine or tobacco products, i.e., cigarettes, vapes, chewing tobacco, etc. (2) no recreational drug usage, (3) no alcohol consumption 12 hours before participation, (4) no personal history of high blood pressure, (5) no psychopathology diagnosis, (6) no chronic physical health problems (i.e., Type II Diabetes, etc.) and (7) no prescription drugs related to numbers 4, 5, and 6 of the health requirements. All participants received course credit for their participation.

Four participants were removed from the data due to bad blood pressure measurements, and 86 participants were left to evaluate. The first demographic obtained was sex. 75.6% of the sample was female, and 24.4% of the sample was male. There was not a significant difference in the sex statistics when compared to gender. The majority race identified in the sample was Caucasian with 70.9%, followed by African American with 20.9%, 1.2% Native American, 1.2% Multiracial, and 5.8% other racial identity. The ethnicity of the sample was majority Not Hispanic or Latino with 82.6%, followed by 12.8% other ethnicity, and 4.7% Hispanic.

Materials

Demographic Questionnaire

This self-report questionnaire asked participants for their age, gender, sex, race, ethnicity, and religious affiliation. Religious affiliation was asked to account for the possibility of religious individuals having a higher trait mindfulness average compared to non-religious individuals as mentioned above, but it was not explored in this study.

Five Facet Mindfulness Questionnaire (*FFMQ*; Baer et al., 2006)

The FFMQ measures mindfulness in five facets: observing, describing, acting with awareness, nonjudging, and nonreactivity. It consists of 39 items rated on a Likert scale of 1 (never or rarely true) to 5 (always or often true). Trait and state mindfulness were observed through the Five Facet Mindfulness Questionnaire (FFMQ), a test for gathering data on an individual's mindfulness levels. The FFMQ has been widely used for mindfulness testing (Carpenter et al., 2019) and has been proven to be a reliable and valid test for different facets of mindfulness (Carpenter et al., 2019).

Toronto Alexithymia Scale-20 (*TAS-20*; Bagby, Parker, & Taylor, 1994)

The TAS-20 measures alexithymia, defined as, "a personality trait characterized by difficultly identifying, describing, and processing emotions, as well as a lack of interest in emotions and thoughts," (MacDonald & Price, 2017, pg. 1647). The TAS-20 consists of 20 items rated on a Likert scale of 1 (strongly disagree) to 5 (strongly agree).

GE Carescape V100 Vital Signs Monitor (General Electric Company; Fairfield, CT)
Blood pressure data was collected using a calibrated GE Carescape V100 Vital Signs Monitor.

Procedures

Participants started by going through the screening process to determine their eligibility for the study. After screening, individuals who fit the requirements read and signed the informed consent document. The order of measurement for blood pressure and psychometric constructs was counterbalanced to control for order effects. Participants were randomly assigned to have their blood pressure taken first or to take the surveys first. Blood pressure measurement took place over a 10-minute recording period wherein participants were seated upright with their feet on the floor and their left arm resting on the chair in an isolated sound-proof participant chamber and instructed not to move. The blood pressure cuff was placed around and above the elbow of the non-dominant arm. Participants had their blood pressure measured discontinuously at 2-minute intervals yielding a total of 6 measurements. If a participant's blood pressure was above the normal values (120mm/80mm), then we were to notify the participant and encourage them to seek medical consultation at the student health center. This event did not occur but was in place for the health and safety of the participants. Psychometric construct measurement took place on a computer workstation in the laboratory. This took approximately 10 to 20 minutes for each participant. After completing both parts of the study, participants were debriefed, assigned their research participation credit, and then dismissed.

Results

The data was inspected for missing values then analyzed in SPSS 26 using univariate procedures to describe the data and examine it for normality. All variables apart from age were approximately normally distributed, with age being positively skewed and leptokurtic. Given the non-normality of age, it was not used in subsequent analyses. See Table 1 for the descriptive statistics results.

Table 1

Descriptive Statistics (n = 86)

	Mean	Standard Deviation	Skewness	Kurtosis
Age	19.09	2.42	4.67	26.09
SBP	110.74	9.33	0.68	0.08
DBP	63.68	5.98	0.26	-0.63
FFMQ Observing	27.62	4.15	-0.13	0.14
FFMQ Describing	24.21	2.64	0.23	0.17
FFMQ Acting	23.09	5.45	0.34	-0.26
FFMQ Nonjudging	23.19	6.03	-0.03	-0.38
FFMQ Nonreactivity	17.42	3.59	-0.09	0.01
TAS Total	57.43	8.27	0.53	0.16

After descriptive statistics were computed, bivariate comparisons were conducted. These revealed a number of expected findings tied to blood pressure and sex, as well. For example, average resting diastolic blood pressure (DBP; $M = 63.68$, $SD = 5.98$) was significantly correlated with average resting systolic blood pressure (SBP; $M = 110.74$, $SD = 9.33$), $r = .53$, $n = 86$, $p < .001$, 95% CI (.36, .67). Additionally, men had higher SBP ($M = 118.40$, $SD = 10.52$) relative to women ($M = 108.27$, $SD = 7.45$), $r = -.47$, $n = 86$, $p < .001$, 95% CI (-.62, -.29).

Other sex differences emerged with respect to participants' scores on the Five Facet Mindfulness Questionnaire (FFMQ). Women (*M* = 24.60, *SD* = 2.61) scored significantly higher than men (*M* = 23.00, *SD* = 2.39) on the FFMQ Describing facet, thus indicating that women self-reported a greater proficiency with describing their own experience than men, $r = .26$, $n = 86$, $p < .001$, 95% CI (.05, .45). Likewise, women (*M* = 19.05, *SD* = 3.83) tended to score significantly lower than men (*M* = 16.89, *SD* = 3.37) on the FFMQ Non-reactivity facet, which indicated that women self-reported having lower detachment from negative thoughts and emotions relative to men, $r = -.26$, $n = 86$, $p < .001$, 95% CI (-.45, -.05).

Resting blood pressure demonstrated few significant relationships between FFMQ scores and Toronto Alexithymia Scale (TAS-20) scores. Indeed, only SBP (*M* = 110.74, *SD* = 9.33) was significantly related to the FFMQ Describing facet scores (*M* = 57.43, *SD* = 8.27), with higher SBP being associated with lower FFMQ Describing facet scores, $r = -.24$, $n = 86$, $p < .001$, 95% CI (-.43, -.03). No other FFMQ or TAS-20 derived variables were significantly related to SBP or DBP. See Table 2 for the results from all of the correlational analyses.

Table 2
Descriptive Statistics and Bivariate Comparisons

	Pearson r							
	1	2	3	4	5	6	7	8
1. Sex	-							
2. SBP	-.47***	-						
3. DBP	.001	.53***	-					
4. FFMQ Observing	-.03	.03	-.04	-				
5. FFMQ Describing	.26*	-.24*	-.05	.17	-			
6. FFMQ Acting	.11	-.04	-.06	-.04	.09	-		
7. FFMQ Nonjudging	.14	.10	-.01	.12	.11	.29**	-	
8. FFMQ Nonreactivity	-.26*	.07	.04	.09	.18	-.13	-.19	-
9. TAS Total	-.006	.09	-.08	.12	-.01	.13	.49***	.02

Note. *p < .05, **p < .01, ***p < .001

Finally, given the significant bivariate relationship between SBP and the FFMQ Describing facet scores, a simultaneous multiple regression was performed to predict FFMQ Describing scores from SBP, sex, and TAS-20. This was done to determine if the relationship between SBP and the FFMQ Describing facet scores remained significant after controlling for the effects of sex and alexithymia. Results revealed that this three-factor model failed to explain a significant amount of variance in FFMQ describing scores beyond what would be expected by chance, F (3, 85) = 2.53, p =.06, R^2 = .09, 90% CI (0, .18). There were no significant partial effects in the model. The absence of significant partial effects might be due to the high degree of multi-collinearity between sex and SBP.

Discussion

This study evaluated resting SBP and the five aspects of trait mindfulness as specified by the FFMQ in order to observe a negative correlation between these variables in a sample of normotensive college students. The results from the bivariate comparisons revealed one negative correlation between the describing aspect of mindfulness, represented by the variable FFMQ Describing and resting SBP, but the simultaneous multiple regression found that the significance of the correlation was minimal. The minimal significance can be explained by the fact that the other predictors, specifically sex and SBP, in the multiple regression had considerable amounts of shared variance to each other and the other variables resulting in null results due to the process of the multiple regression analysis ignoring the shared variance. Additionally, to reiterate, no other sub scores from the FFMQ were significant with resting SBP. Therefore, the null hypothesis is retained due to the simultaneous multiple regression failing to explain the relationship between the FFMQ Describing scores and SBP and due to no other FFMQ categories displaying significant correlation to resting SBP.

Despite these null findings, there is a possibility that the FFMQ Describing scores and resting SBP averages have a small relationship that the present study is not sufficiently powered to detect. It is also possible that the regression analysis is accurate, and there might be no appreciable relationship between resting blood pressure and the various facets of trait mindfulness. Additional research is needed to explore the relationships between these phenomena further.

If differences in resting blood pressure do not predict differences in trait mindfulness, then the processes that underlie the cardiovascular emotional dampening phenomenon might not have much of an impact on our ability to be mindful. The practice of mindfulness involves higher cortical CNS processing (Parkinson et al., 2019), and this might include sections of the brain that are generally unaffected by the inhibitory signaling related to cardiovascular emotional dampening. The mechanistic independence between these two processes might have implications for the prevention of heart disease. Mindfulness training has been shown to increase trait mindfulness (Kiken et al., 2015), and trait mindfulness has been correlated to a decreased risk of hypertension and cardiovascular disease (Loucks et al., 2015). It could be possible that the practice of mindfulness and building trait mindfulness might alleviate the effects of the cardiovascular emotional dampening process via changes in the top-down management of cardiovascular functioning. This would have to be explored in future research.

In addition, there are other significant correlations that were not observed due to them being unrelated to the hypothesis of the study. Within the bivariate comparisons results presented in Table 2, a small significant correlation was found between sex and the FFMQ Describing scores, a medium significant positive correlation was found between the TAS-20 total scores and the FFMQ Non-judging scores, and a small significant negative correlation was found between sex and the FFMQ Non-reactivity scores. These relationships could be further examined in future studies.

Limitations

There are multiple limitations to this study. One limitation is the sample not representing the population as expected. The majority of participants identified as white and as biological women, which is not fully representative of the population. Therefore, the results of this study may apply mainly to Caucasian women rather than other sexes, races, and ethnicities. Any future study should strive to reach a diverse audience representative of the general population or select groups could be identified and targeted for recruitment such as minority races and ethnicities or biological men. A second limitation is the issue of reporting from participants who could have cardiovascular emotional dampening. Those who have cardiovascular emotional dampening cannot report their experience of stress accurately. Therefore, if any participants were to have cardiovascular emotional dampening, then their reports on the FFMQ may be inaccurate.

The third limitation is the fact that this study is correlational as opposed to experimental. Correlational studies can only make predicted correlations. Experimental studies have more weight in their results because those studies can control variables and observe connections as a result of controlling the variables, while correlational studies can only observe connections between variables. Therefore, any future study could attempt an experimental model as opposed to a correlational model.

Finally, a multiple regression model for analysis may not be the best statistical tool for analyzing the relationship between resting SBP and the FFMQ Describing scores due to the issue regarding shared variances and how multiple regression analyses operate, specifically by disregarding shared variances. Any future studies should find a statistical tool or multiple statistical tools better suited for the analysis of this relationship due to the shared variances.

Conclusion

This study explored the relationship between resting blood pressure and facets of trait mindfulness in order to determine if trait mindfulness might be implicated in the cardiovascular emotional dampening phenomenon. While the present findings did not reveal robust support for the relationship between trait mindfulness and resting blood pressure, such findings could have important implications for how practices that enhance trait mindfulness might be used to reduce cardiovascular disease risk among emotionally dampened individuals. Further research is needed to clarify the relationship between trait mindfulness and resting blood pressure.

References:

American Psychological Association. (2011, January). *Stressed in America*. www.apa.org; American Psychological Association. https://www.apa.org/monitor/2011/01/stressed-america

An, Y., Schoebi, D., & Xu, W. (2018). How does mindfulness modulate daily stress response: Evidences from ambulatory assessment. *Psychology & Health*, *34*(3), 355–367. https://doi.org/10.1080/08870446.2018.1539488

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, *13*(1), 27–45. https://doi.org/10.1177/1073191105283504

Bagby, R. Michael., Parker, J. D. A., & Taylor, G. J. (1994). The twenty-item Toronto alexithymia scale—I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research*, *38*(1), 23–32. https://doi.org/10.1016/0022-3999(94)90005-1

Bhasin, M. K., Denninger, J. W., Huffman, J. C., Joseph, M. G., Niles, H., Chad-Friedman, E., Goldman, R., Buczynski-Kelley, B., Mahoney, B. A., Fricchione, G. L., Dusek, J. A., Benson, H., Zusman, R. M., & Libermann, T. A. (2018). Specific transcriptome changes associated with blood pressure reduction in hypertensive patients after relaxation response training. *The Journal of Alternative and Complementary Medicine*, *24*(5), 486–504. https://doi.org/10.1089/acm.2017.0053

Bruehl, S., & Chung, O. Y. (2004). Interactions between the cardiovascular and pain regulatory systems: An updated review of mechanisms and possible alterations in chronic pain. *Neuroscience & Biobehavioral Reviews*, *28*(4), 395–414. https://doi.org/10.1016/j.neubiorev.2004.06.004

Carpenter, J. K., Conroy, K., Gomez, A. F., Curren, L. C., & Hofmann, S. G. (2019). The relationship between trait mindfulness and affective symptoms: A meta-analysis of the five facet mindfulness questionnaire (FFMQ). *Clinical Psychology Review*, *74*, 101785. https://doi.org/10.1016/j.cpr.2019.101785

CDC. (2019). *Preventing heart disease: What you can do*. Prevent Heart Disease; Center for Disease Control and Prevention. https://www.cdc.gov/heartdisease/prevention.htm

CDC. (2020, September 8th). *Heart disease facts & statistics*. Center for Disease Control and Prevention; U.S. Department of Health and Human Services. https://www.cdc.gov/heartdisease/facts.htm

Delgado, L. C., Vila, J., & Reyes del Paso, G. A. (2014). Proneness to worry is negatively associated with blood pressure and baroreflex sensitivity: Further evidence of the blood pressure emotional dampening hypothesis. *Biological Psychology*, *96*, 20–27. https://doi.org/10.1016/j.biopsycho.2013.11.005

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Kiken, L. G., Garland, E. L., Bluth, K., Palsson, O. S., & Gaylord, S. A. (2015). From a state to a trait: Trajectories of state mindfulness in meditation during intervention predict changes in trait mindfulness. *Personality and Individual Differences*, *81*, 41–46. https://doi.org/10.1016/j.paid.2014.12.044

Korner, P. I. (2007). *Essential hypertension and its causes: Neural and non-neural mechanisms*. Oxford University Press.

Kudielka, B. M., & Kirschbaum, C. (2001). Stress and health research. *International Encyclopedia of the Social & Behavioral Sciences*, 15170–15175. https://doi.org/10.1016/b0-08-043076-7/03818-3

Kulkarni, S., O'Farrell, I., Erasi, M., & Kochar, M. S. (1998). Stress and hypertension. *WMJ: Official Publication of the State Medical Society of Wisconsin*, *97*(11), 34–38. National Library of Medicine. PMID: 9894438

Loucks, E. B., Schuman-Olivier, Z., Britton, W. B., Fresco, D. M., Desbordes, G., Brewer, J. A., & Fulwiler, C. (2015). Mindfulness and cardiovascular disease risk: State of the evidence, plausible mechanisms, and theoretical framework. *Current Cardiology Reports*, *17*(12). https://doi.org/10.1007/s11886-015-0668-7

Loveless, J. P., Nicoletta, A. J., Winters, A. R., Carels, R. A., Wuensch, K. L., Whited, M. C., McCubbin, J. A., & Everhart, D. E. (2018). Exploring the relationship between frontal asymmetry and emotional dampening. *International Journal of Psychophysiology*, *123*, 8–16. ScienceDirect. https://doi.org/10.1016/j.ijpsycho.2017.12.003

MacDonald, H. Z., & Price, J. L. (2017). Emotional understanding: Examining alexithymia as a mediator of the relationship between mindfulness and empathy. *Mindfulness*, *8*(6), 1644–1652. https://doi.org/10.1007/s12671-017-0739-5

McCubbin, J. A., Helfer, S. G., Switzer, F. S., Galloway, C., & Griffith, W. V. (2006).

Opioid analgesia in persons at risk for hypertension. *Psychosomatic Medicine*, *68*(1), 116–120. https://doi.org/10.1097/01.psy.0000195742.24850.79

McCubbin, J. A., Loveless, J. P., Graham, J. G., Hall, G. A., Bart, R. M., Moore, D. D., Merritt, M. M., Lane, R. D., & Thayer, J. F. (2014). Emotional dampening in persons with elevated blood pressure: Affect dysregulation and risk for hypertension. *Annals of Behavioral Medicine*, *47*(1), 111–119. Gale Academic OneFile. https://doi.org/10.1007/s12160-013-9526-2

McCubbin, J. A., Merritt, M. M., Sollers III, J. J., Evans, M. K., Zonderman, A. B., Lane, R. D., & Thayer, J. F. (2011). Cardiovascular-Emotional dampening: The relationship between blood pressure and recognition of emotion. *Psychosomatic Medicine*, *73*, 743–750. https://doi.org/10.1097/PSY.0b013e318235ed55

McCubbin, J. A., Nathan, A., Hibdon, M. A., Castillo, A. V., Graham, J. G., & Switzer, F. S. (2018). Blood pressure, emotional dampening, and risk behavior: Implications for hypertension development. *Psychosomatic Medicine*, *80*(6), 544–550. https://doi.org/10.1097/PSY.0000000000000598

Nardi, W. R., Harrison, A., Saadeh, F. B., Webb, J., Wentz, A. E., & Loucks, E. B. (2020). Mindfulness and cardiovascular health: Qualitative findings on mechanisms from the mindfulness-based blood pressure reduction (MB-BP) study. *PLOS ONE*, *15*(9), e0239533. https://doi.org/10.1371/journal.pone.0239533

Parkinson, T. D., Kornelsen, J., & Smith, S. D. (2019). Trait mindfulness and functional connectivity in cognitive and attentional resting state networks. *Frontiers in Human Neuroscience*, *13*, 112. https://doi.org/10.3389/fnhum.2019.00112

Piotrowski, N. A. (2020). Stress reduction. *Magill's Medical Guide (Online Edition)*. Research Starters. Search text: "Stress reduction."

Pury, C. L. S., McCubbin, J. A., Helfer, S. G., Galloway, C., & McMullin, L. J. (2004). Elevated resting blood pressure and dampened emotional response. *Psychosomatic Medicine*, *66*(4), 583–587. https://doi.org/10.1097/01.psy.0000130490.57706.88

Ramamoorthy, S., & Cidlowski, J. A. (2016). Corticosteroids. *Rheumatic Disease Clinics of North America*, *42*(1), 15–31. https://doi.org/10.1016/j.rdc.2015.08.002

Romero, L. M. (2019). Fight or flight responses. *Encyclopedia of Animal Behavior*, 547–552. https://doi.org/10.1016/b978-0-12-809633-8.20760-7

Tsigos, C., Kyrou, I., Kassi, E., & Chrousos, G. P. (2000). *Stress: Endocrine physiology and pathophysiology*. National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/books/NBK278995/

Vianna, P., Bauer, M. E., Dornfeld, D., & Chies, J. A. B. (2011). Distress conditions during pregnancy may lead to pre-eclampsia by increasing cortisol levels and altering lymphocyte sensitivity to glucocorticoids. *Medical Hypotheses*, *77*(2), 188.

Wright, K. D., Klatt, M. D., Adams, I. R., Nguyen, C. M., Mion, L. C., Tan, A., Monroe, T. B., Rose, K. M., & Scharre, D. W. (2020). Mindfulness in motion and dietary approaches to stop hypertension (DASH) in hypertensive African Americans. *Journal of the American Geriatrics Society*. https://doi.org/10.1111/jgs.16947

IRB Approval

IRB
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MIDDLE TENNESSEE STATE UNIVERSITY

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Wednesday, June 09, 2021

Protocol Title	***Mind your Pressure: A Study on the Effect of Trait Mindfulness on Resting Blood Pressure***
Protocol ID	**21-2195 47i**
Principal Investigator	**Hailey Hall** (Student)
Faculty Advisor	James P. Loveless
Co-Investigators	Jamie Danford (jld9p), Nicholas Trogdon (nmt2w) and Ally Farley (akt3e)
Investigator Email(s)	*h4h3e@mtmail.mtsu.edu; james.loveless@mtsu.edu*
Department	Psychology
Funding	**NONE**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU IRB through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within a PRIMARY category *(4) Collection of data through noninvasive procedures* under the subcategory *4a physical sensors (blood pressure)* and a SECONDARY category *(7) Research on individual or group characteristics or behavior*. A summary of the IRB action on this protocol is given below:

IRB Action	**APPROVED for ONE YEAR**		
Date of Expiration	**6/30/2022**	*Date of Approval*: 6/9/21	*Recent Amendment*: NONE
Sample Size	FIVE HUNDRED (500)		
Participant Pool	*Target Population:* Primary Classification: **General Adults (18 or older)** Specific Classification: **Healthy individuals with no history of cardiovascular, endocrine, or psychiatric problems. The population also includes SONA registrants.**		
Type of Interaction	☐ Non-interventional or Data Analysis ☐ Virtual/Remote/Online interaction ☒ **In person or physical interaction – Mandatory COVID-19 Management**		
Exceptions	Contact information is permitted.		
Restrictions	**1. Mandatory SIGNED Informed Consent.** **2. Other than the exceptions above, identifiable data/artifacts, such as, audio/video data, photographs, handwriting samples, personal address, driving records, social security number, and etc., MUST NOT be collected. Recorded identifiable information must be deidentified as described in the protocol.** **3. Mandatory Final report (refer last page).** **4. Compensation documentation is not approved.** **5. CDC guidelines and MTSU safe practice must be followed**		
Approved Templates	*IRB Templates:* Signature Informed Consent and SONA Script *Non-MTSU Templates:* Recruitment Script		
Research Inducement	Course credit for SONA and Amazon gift card raffle for others		
Comments	NONE		

IRBN001 (Stu) Version 2.0 Rev 08/07/2020