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## **Cover Page Footnote**

I am extremely grateful for the assistance given by Dr. Justin Laplante for his insightful comments during the development and review of this work. I would also like to thank my family, friends, and girlfriend for their endless support. The author does not have any sources of financial support to disclose in regards to the creation of this work.

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# Efficaciousness of Mindfulness Interventions for Trauma Using Psychophysiological Measures: A Review

Sherief Eldeeb

## ABSTRACT

In recent decades the efficaciousness of mindfulness has been proven in a wide variety of contexts, but some crucial populations remain understudied. This review critically examines the literature on mindfulness in individuals with trauma using psychophysiological measures. Psychophysiological measures offer critical insight into this intersection of mindfulness and trauma due to the known somatic components in each, as well as serving as an objective response. Mindfulness-based treatments seem to show great promise in treating trauma, however there are significant limitations in the literature. Future studies should standardize the minimum length of treatment, utilize gender-balanced and ethnically diverse samples, and introduce psychophysiological measures such as heart rate variability.

## Introduction

Mindfulness meditation has gained acceptance within mainstream culture to the extent that words that would have been unfamiliar just a few generations ago, such as yoga or nirvana, are now easily recognizable. Much of this recognition can be attributed to the large body of research produced on its beneficial effects since the 1970s, as well as the emergence of mindfulness based treatments such as Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive Therapy (MBCT), and Acceptance and Commitment Therapy (ACT). However, simply because the subject in general has been widely studied internationally does not mean there are not significant gaps in the literature on the subject; if anything, these gaps become ever more glaring because of this fact. Germer and colleagues (2005), in their book *Mindfulness and Psychotherapy*, called for expanded research on what types of mindfulness interventions are effective and with which specific populations. The present review hopes to accomplish this by laying the groundwork for researching the efficacy of mindfulness interventions with trauma-exposed populations through the usage of psychological and psychophysiological measures. As this area of research is

notably bare, the author will accomplish this overview by separately reviewing the literature on the efficacy of mindfulness interventions with trauma-exposed population and the wider literature on the psychophysiological effects of mindfulness interventions. The author will begin by offering brief introductions to the fields of study of mindfulness meditation, trauma, and the usage of psychophysiological measures, as well as the theoretical underpinnings of the usage of mindfulness in the treatment of trauma, in order to ensure a base level of understanding for the reader.

## *Mindfulness*

Mindfulness has been described as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally... which nurtures greater awareness, clarity, and acceptance of present-moment reality” (Kabat-Zinn, 1994, p. 4). Please note that the author believes it is essential to understand the cultural context in which the practice originates; however, as this is not a theological piece, only a brief introduction will be offered.

Mindfulness practice has its origins in Buddhist philosophy as part of the Eightfold Path, where it is

grouped with the tenets of right concentration and right effort (Nilsson & Kazemi, 2016). However, the practice of mindfulness has drawn direct comparisons to other religious practices outside of Buddhism and culturally adapted therapies have been developed based on this theory (Lau, 2006). In other words, this practice has proven applications for non-Buddhists as well.

For Western audiences, mindfulness is typically thought of as a method of self-regulation, whereas for Eastern audiences it is typically seen as a method to cultivate *samatha* and acceptance (Aitken, 1982). *Samatha* is the “state in which the mind is focused only on one item, brought to rest, and not allowed to wander” (Gunaratana, 2002, p.3). Therefore, in Buddhism, mindfulness practice is not inherently seen as a relaxation technique but a technique to improve awareness (Gunaratana, 2002). This is typically taught through anchoring the meditator’s attention on the somatic sensations of the participant, and especially on the breath (Aitken, 1982). This notion of *samatha* has incredibly important implications for the treatment of trauma-exposed individuals and will be discussed in more detail later.

A central tenet in Buddhism is that life is suffering, and it is argued that mindlessness is what mainly leads to this dysfunction (Gunaratana, 2002; Nilsson & Kazemi, 2016). Mindfulness, then, offers a path to alleviate this suffering. Mindfulness meditation is thought to offer this ability from a Buddhist perspective through allowing the participant to possess clearer vision to the reality of their situation as well as cleansing the psyche from negative mental states (Gunaratana, 2002). Germer and colleagues (2005) describe that it is at this point that the study of Buddhism and clinical psychology merge: both attempt to alleviate the suffering of individuals. It is at this common point that is of particular interest to the author, as it is at this common point that the subject of trauma will be focused.

### *Trauma*

Trauma has been described by the American Psychiatric Association as “clinical distress following exposure to catastrophic or aversive events” (APA, 2013, p. 265). As the reader is likely most familiar with Post-traumatic stress disorder (PTSD) in regards to the subject of trauma, it is essential to note that individuals can be trauma-exposed but not have the severe subset of symptoms necessary for a PTSD diagnosis. However, by looking at some factors related to PTSD, we are able to view some of the central factors related to trauma. There are four subset symptom clusters for PTSD: intrusive re-exposure to traumatic events; avoidance of

stimuli; negative changes to cognition and mood; and hyperarousal and reactivity (APA, 2013, pp. 271-272). Of these, avoidance is especially noted as the main behavior contributing to the continuation of traumatic symptoms (Plumb & Follette, 2006). In other words, trauma, much like the more typical American mindset, is based around the central method of avoidance rather than acceptance. This is especially troublesome as Wegner and colleagues (1987) found that the conscious avoidance of thoughts causes them to occur more frequently, initializing a vicious cycle for those afflicted with trauma. This is where the concept of *samatha* is theorized to assist with the treatment of trauma. Follette and colleagues (2006) theorize that mindfulness treatment has the benefit of decreased avoidance behavior for trauma treatment due to its focus on acceptance, as well as the importance of focusing on the present moment assisting in the prevention of flashbacks. As a major feature of mindfulness meditation is a greater awareness of knowing your body and its somatic sensations, it is theorized that victims of trauma will be able to self-regulate more effectively by recognizing when they are in the presence of a trigger from bodily responses (Brown & Ryan, 2003). Furthermore, mindfulness treatment is said to result in more present-focused attention, reduced avoidance, and increased attention (Follette, Palm, & Pearson, 2006). Mindfulness interventions also offer an alternative to exposure therapies, which may be seen as too unappealing or (particularly with this condition) too distressful by the patient. It is because of these factors of decreased avoidance and increased awareness that mindfulness interventions are seen to have immense potential in the treatment of trauma.

### *Psychophysiology*

As the study of psychophysiology is likely the most unfamiliar to the general reader, a short introduction will be offered discussing the techniques commonly used in this type of study and their relevance to psychophysiology study. Psychophysiology, much like the name suggests, is the study of psychological processes through the usage of physiological measures. This offers distinct benefits to the study of both mindfulness and trauma due to the known somatic connections to both, such as body scanning and breath anchoring specifically in mindfulness meditation. Furthermore, psychophysiological measures offer a distinct advantage specific to the study of mindfulness meditation. The usage of psychophysiological measures offers the ability to act as an objective proxy for many of the processes and benefits associated with mindfulness meditation

such as emotion regulation, responsiveness, attention, stress, and emotional arousal as specified below. This is especially important as self-report has been argued by some to be ill-fitting for mindfulness research due to focusing on things only related to mindfulness, the possibility of very different interpretations in the wording of measures dependent on the participants' exposure and experience with mindfulness, and a lack of congruent terminology across different branches of mindfulness meditation (Grossman & Van Dam, 2011). Therefore, the usage of psychophysiological measures offers a possible solution to a noted limitation with current research designs in the measurement of mindfulness.

Heart rate variability (HRV) is one of the most used psychophysiological measures for mindfulness research due to its representation of many of the defined outcomes desired of mindfulness research. HRV is defined as the peak to peak distance in between heartbeats and is typically seen as an objective proxy for emotion regulation and responsiveness—themes central to the study of mindfulness in the West (Appelhans & Luecken, 2006; Berntson et al., 1997). As the literature is reviewed below please keep in mind that increased heart rate variability is seen as the ideal outcome when it is used. This is because greater HRV is purported to display the adaptive ability to alternate the from high to low arousal states (displaying a shift from sympathetic to parasympathetic nervous system responses) (Appelhans & Luecken, 2006). The usage of HRV has added benefits specifically for mindfulness and trauma-related research as greater HRV has been associated with increased attention, a desired outcome in both fields (Chida & Steptoe, 2010).

Blood pressure (BP) measurements are more intuitive to a general audience so it will not be discussed in depth. There are two components of blood pressure measurements: systolic and diastolic blood pressure. Systolic blood pressure represents the pressure in blood vessels when the heart beats, whereas diastolic blood pressure represents the pressure exerted when the heart is resting. Higher blood pressure represents greater arousal and stress and so, for the purposes of this paper, a decreased BP from baseline is preferred.

Mindfulness meditation is purported to affect the body through stress responses in the hypothalamus-pituitary-adrenocortical (HPA) and the sympathetic adrenal medullary (SAM) axis (Kirschbaum & Hellhammer, 1993). This is what salivary cortisol measurements are attempting to display. Cortisol is a stress hormone validated for use for psychological stress and is typically collected by obtaining saliva at specific time points from the stressor and baseline readings and spinning down the saliva to extract cortisol readings. Although

amylase has proven to be a more sensitive measure than cortisol, cortisol is much more widely used and represented in the literature so this will remain this paper's focus (Takai, Yamaguchi, Aragaki, Eto, Uchihashi, & Nishikawa, 2004). For the purposes of this paper, decreased cortisol measurements is seen as ideal as this will represent decreased stress.

The last psychophysiological measure typically used is galvanic skin response (GSR) or skin conductance response (SCR). Skin conductance is a measure of emotional arousal, regardless if it is a positive or negative emotion. As such, SCR can also be used as a measure of affective empathy responses. Greater skin conductance represents increased emotional arousal, so for the purposes of this paper an ideal result will display decreased skin conductance from baseline (Boucsein, 2012). Through these diverse methods it may be possible to measure the multi-faceted nature of mindfulness constructs ranging from attention to affective empathy responses.

### **Mindfulness with Trauma-Exposure**

In order to gain an overview of the current findings and limitations of this branch of study, a recent meta-analysis by Hilton and colleagues (2016) will be analyzed. Hilton and colleagues looked only at randomized controlled trials (the "gold standard" of research study design) to study the efficacy of meditation on PTSD reduction and in doing so were able to combine the results of ten studies to gain a total sample size of 643 participants. Of these ten studies, five of them utilized MBSR whereas the remainder utilized yoga or mantra based meditation programs. The authors labeled only three of the ten studies as "good" quality studies, regarding sample size and methodology. The length of interventions ranged from four to 12 weeks, but the average length of programs was eight weeks. Sample sizes ranged from 28 to 146 with seven studies reporting 80% or higher samples of males and three studies reporting roughly 90-100% female participants. Statistically, meditation was found to be significantly more effective compared to treatment as usual (TAU) on reduction of PTSD symptomology with no difference across meditation types. However, they expressed caution about this claim due to the great variation in experimental factors such as study and follow-up time, as well as noted differences in study quality. The authors had two recommendations for future research in this field; these include the need for more large RCTs of high quality to produce reliable findings, and the standardization of the length of experimental interventions by finding the minimum treatment length required for

maximum efficaciousness (Hilton et al., 2016). This call for standardization of treatment length has been expressed by other authors, with a review noting a non-significant difference in effect sizes in 29 studies with in-class hours ranging from six to 28 hours (Carmody & Baer, 2009). However, as far as the author is aware, this need in the literature has not been experimentally tested yet and is an area of necessary concern.

One of the earliest studies conducted investigating the efficacy of mindfulness interventions for trauma also displays similar themes to those listed above. An eight-week MBSR intervention with follow-up and a refresher session at 24 weeks was conducted with 23 participants who were adult survivors of child abuse (Kimbrough, Magyari, Langenburg, Chesney, & Berman, 2010). The sample was comprised of 89% female participants. At eight weeks, symptoms of avoidance were greatly reduced and this finding was substantiated to a lesser degree at 24 weeks. The PTSD mean score of the participants decreased 31% and at eight weeks roughly half meeting baseline PTSD levels for a diagnosis decreased compared to at baseline. However, the level of those reaching diagnosis levels was nonsignificant at 24 weeks (Kimbrough et al., 2010). This study was interesting since a follow-up study was conducted two-and-a-half years later to determine if the effects were substantiated. Of the original 23 participants, 19 were brought back in. Compared to the original baseline averages, there exists a statistically significant ( $p < .0001$ ) reduction of mean PTSD scores, increased mindfulness levels, and decreased avoidance, re-experiencing, and hyperarousal levels. However, these values were higher than those observed at 24 weeks. Furthermore, compared to baseline, there was a statistically significant reduction of diagnosis levels ( $p < .05$ ). This offers evidence for long-term benefits associated with mindfulness interventions (Earley, et al. 2014). However, it is important to note that this experiment has very significant methodological flaws. The sample size is small, there was no control or comparison sample, and there is a lack of generalizability of results due to the sample being composed of 89% female and 78% Caucasian participants. This experiment offers a groundwork for future studies and a display of the potential positive and long-lasting effects mindfulness interventions could have for the study of trauma.

Dutton and colleagues (2013) conducted one intervention that had a more sound methodology, as well as a larger and more diverse sample. The authors tested an eight-week (ten session) group therapy MBSR intervention with a majority (67.3%) African-American, low-income, and exclusively female sample comprising 106 randomized individuals. Inclusion of the sample

was based on reported lifetime interpersonal violence exposure and PTSD. A main goal of this experiment was to address the viability of using mindfulness interventions to address mental health disparities. This aim led to an interesting inclusion in the design of the study, particularly in the way that the feasibility and acceptability of mindfulness intervention were defined within this sample.

Feasibility was defined as an interest in participating in the intervention, and the continuation of doing so if they were selected for the experiment. Of the 158 eligible female participants for the study, 97% expressed an interest in the intervention. Mean and median attendance for the women in the sample were seven and eight sessions respectively, which is fairly promising. Seventy percent of the women attended at least half of the sessions offered. A noted issue was the difficulty of formal at-home practice, but many participants reported that they supplemented this with informal practice instead. Acceptability was defined as if the sample believed the intervention to be “relevant and useful in their lives in some way” (Dutton et al., 2013, p. 7). The authors reported that the participants frequently reported benefits including: increased awareness; self-acceptance; self-empowerment; nonreactivity; self-care; and decreased distress.

There are, of course, some caveats of these results. The authors noted issues including a participant desire for greater “emotional assistance” during the process; triggered panic attacks from body scan; dissociation; lack of clear expectations; conflict with personal religious values; and interpersonal conflicts due to the group nature of the method. Furthermore, the data is anecdotal and no clinical reports or self-report were made of symptom reduction using psychometrics. However, this experiment displays promise for the adaptation of mindfulness interventions for trauma and for their usage in addressing mental health disparities as well as offering warnings for future studies (Dutton et al., 2013).

Two studies offer strong examples of the efficacy of mindfulness interventions for treating PTSD. Both studies employed RCT designs for eight weeks comparing MBSR (mantra-based and mindfulness in Heffner, Crean, & Kemp, 2016) to TAU with veterans. Both studies had large (315 and 116) samples, which were majority male (90% and 84%), and Caucasian (70% and 84%) participants (Heffner, Crean, & Kemp, 2016; Polusny et al., 2015). Furthermore, both studies administered both self-report and clinical ratings in regards to PTSD severity and diagnosis. Heffner and colleagues (2016) accumulated results drawn from six Veterans Affairs (VA) sites across the country reporting on four

mantra-based interventions and two mindfulness interventions, whereas Polusny and colleagues (2015) reported on results drawn from only one VA site using MBSR.

Polusny and colleagues (2015) reported that at three weeks there was actually an increase in PTSD severity in both interventions, but at a two-month follow-up both interventions improved compared to baseline readings with the mindfulness intervention displaying statistically significant improvement over TAU (in this case, present-centered therapy). Likewise, through clinical interviews it was noted that the mindfulness intervention displayed statistically significant improvement at decreasing PTSD symptom severity compared to the TAU sample. However, neither at the end of the intervention nor at the two month follow-up was there any difference with a change in PTSD status. Participants in the mindfulness intervention group reported significantly greater quality of life at follow-up, suggesting an enduring, subjective improvement.

Heffner and colleagues (2016) reported no significant differences between mantra-based and mindfulness interventions, so these results will be spoken about collectively. These authors found that compared to TAU (in this case prolonged exposure therapy), in both clinical interviews and through self-report, mindfulness significantly decreased PTSD symptoms with a medium effect size difference. Furthermore, there was a larger reported mindfulness measure in the mindfulness condition displaying a valid intervention. Finally, individuals in the mindfulness intervention group were found to have more nonreactivity to inner exposure, a parameter desired in this population. Results from these experiments seem to suggest that mindfulness interventions are a viable treatment method for trauma-exposed populations and match expectations for the reduction of avoidant behaviors.

### Mindfulness and Psychophysiology

As there is a wide variety in methodologies for these studies, the more ‘traditional’ or ‘lengthy’ mindfulness interventions will be reviewed first and then the more brief interventions will be reviewed last. Psychophysiology studies have taken the calls of Carmody and Baer (2009) to test different temporal limits on experimental mindfulness practice to its limits, with differing results. As a result, the literature is somewhat mixed and this very well could come down to an issue of ‘dosage.’

Gallegos and colleagues (2015) tested the effects of an eight-week group therapy MBSR intervention with a follow-up at four weeks with 42 women exposed to interpersonal trauma for self-reported stress,

PTSD symptoms, emotion regulation, and inflammatory immune biomarkers. They found that with more time in the program, there was significantly reduced stress, PTSD symptoms, and increased reported emotion regulation. Likewise, there was significantly more reporting of mindfulness trait scores for dispositional mindfulness.<sup>1</sup> The attendance of MBSR sessions, not time spent in independent practice, was found to cause less inflammatory immune response. Research participants were reminded of the appointments and offered compensation for child care as well as travel (Gallegos, Lytle, Moynihan, & Talbot, 2015). This is the first experiment found by the author that studied mindfulness, trauma, and psychophysiological responses. However, this was done through immunology rather than through traditional psychophysiological measures. Unfortunately, there were no controls in this sample nor a large sample size so although the findings are heartening, there is still work to be done. In contrast, the next study examined had a larger sample size and a control, but no follow-up.

Nyklicek and colleagues (2013) studied the effects of an eight week MBSR intervention for HRV, BP, and cortisol measurements following an acute stressor of a math and speech task. Eighty-five participants (71% female) were randomly assigned to either the MBSR condition or a waitlist control. Systolic and diastolic BP were found to have significantly lower reactive changes in the mindfulness condition compared to the waitlist control, signifying less reaction to stressors. Furthermore, BP overall was significantly lower in the mindfulness condition compared to the waitlist control. However, there was no significant difference in HRV or salivary cortisol between the groups with or without a stressor. Both of these findings are initially counterintuitive, but the authors noted a possible issue in the study design of not having a panel of individuals judging the speech task which may have reduced the social threat response enough for a resistance in cortisol readings (Nykliček, Mommersteeg, Van Beugen, Ramakers, & Van Boxtel, 2013). This finding of decreased diastolic BP, as well as an added finding of increased pain tolerance, was also found in a study conducted by Kingston and colleagues (2007) after 42 participants (of which 33 were female) were taught mindfulness techniques for six one-hour

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<sup>1</sup> Dispositional, or trait mindfulness, is how mindful a person generally is in their lives. It is seen as more stable to change than state mindfulness, which would be how particularly mindful a person is at any one moment in time. It is believed that if you train state mindfulness, you will develop more dispositional mindfulness.



sessions. Compared to a guided imagery condition the reduction in diastolic BP was non-significant, whereas the increase in pain tolerance remained significant (Kingston, Chadwick, Meron, & Skinner, 2007).

Krygier and colleagues (2013) studied 36 participants before and after a ten day intensive *Vipassana* retreat, rather than using typical experimental interventions for mindfulness such as MBSR, MBCT, DBT, or ACT. Self-report was used to study well-being, ill-being, life satisfaction, positive affect, and mindfulness whereas physiological data was used to study HRV. Following the retreat the participants had significantly higher well-being, life satisfaction, positive affect, and mindfulness while having lower self-reported ill-being when compared to baseline. However, there were no differences before and after in regards to HRV. This was true unless the subjects were meditating in which a difference with a large effect size was observed in regards to HRV. The authors postulated that this dramatic difference in HRV was due to increased ‘flow state’ from the breath training involved with the meditation practice. This finding could explain the null findings of the other experiments in regards to HRV if the measurements compared were done while the participant was not meditating (Krygier, Heathers, Shahrestani, Abbott, Gross & Kemp, 2013).

A study of a brief mindfulness intervention with a randomized control trial design that had interesting findings was conducted by Azam and colleagues in 2015. Maladaptive perfectionists were compared to healthy individuals using HRV following a five-minute cognitive stressor and a ten-minute audio recording of a guided meditation. Control individuals showed significantly greater HRV compared to resting state after the stressor and guided meditation. However, this finding was not replicated in the maladaptive perfectionists as there was no significant change in HRV. This finding has the implication that mindfulness meditation has the potential to increase relaxation in average individuals, but not those with certain conditions. It is not believed that this finding would be replicated in individuals with trauma, and it is a pertinent reminder that mindfulness meditation may not be a “one-size-fit-all” solution. Furthermore, it is very interesting to see that significant relaxation effects were found from a 1-time, 10-minute mindfulness meditation exercise (Azam et al., 2015).

In contrast to these findings, Creswell and colleagues (2014) found an increased cortisol response to a social stressor task in individuals who had undergone a three-time, 25-minute mindfulness training regimen compared to those who were taught critical reading skills for the same amount of time. This finding held true even though those who underwent the mindful-

ness training had lower self-reported perceived stress. These findings are counterintuitive as it would be expected that since self-reported psychological stress decreased, the physiological representation of this (cortisol) would as well. When dispositional mindfulness was included as a mediator, it was found that those with low dispositional mindfulness that received mindfulness training had the highest cortisol response. The authors hypothesized that these factors could be understood that meditators had a more effortful and conscious coping response compared to those taught to analyze poetry leading to a greater physical response. Another view of this argument was also argued by the authors in that the greater effort in response led to more depletion of cognitive resources and so more physiological stress. It is also possible, similar to Polusny and colleagues (2015) reviewed above, that response to mindfulness interventions initially worsens before physiological improvement. The other physiological measure used, blood pressure, had null findings in both conditions. With these null and unexpected findings, it is important to note a few flaws in the design of the experiment. There was no pre-post comparison to control for stress reactivity in each condition, as well as a check for a possible habituation effect due to the same social stressor being used twice.

Two other experiments testing brief mindfulness interventions also resulted in null findings regarding psychophysiological measures. Erisman and Roemer (2010) noted null findings for both HRV and skin conductance when 33 individuals were tasked with watching positive, distressing, and mixed emotion film clips following a ten minute meditation exercise when compared to a control sample. However, emotion regulation and responsiveness had a significant increase for the positive and mixed videos when self-report was taken into account. Similarly, when participants were tasked with listening to a 15-minute mindfulness intervention there was no significant difference with either HRV or skin conductance when compared to individuals listening to National Public Radio for the same amount of time on an emotion regulation task. However, individuals in the mindfulness condition did report significantly increased mindfulness scores compared to controls and nonsignificant but greater positive affect through self-report (Watford & Stafford, 2015). These findings offer two possible explanations: HRV could be nonsignificant due to its measurement when subjects were not meditating, or that such short-term mindfulness meditation exercises are not large enough ‘doses’ to cause physiological changes.

## Conclusion and Future Research

Given the evidence displayed above, mindfulness interventions have significant potential to assist those affected with trauma. However, much still needs to be done in order to make bolder and substantiated claims. Likewise, mindfulness research also seems to have significant implications when used in conjunction with psychophysiological research, but with large caveats and warnings from previously conducted research.

First and foremost, a standardized and shortened mindfulness intervention must be developed in order to grant the ability to make meaningful comparisons between research (Carmody & Baer, 2009). Until this is done, more research must be conducted with the current established eight-week MBSR protocol, or one of equivalent length, with psychophysiological measures in order for a standard to emerge to compare reliable results. Research must also be conducted with larger and more diverse (both in ethnicity and gender) samples in order to make reliable and generalizable claims as this has been a noted fault in the research as shown above. One review found that male participants had less than 29% representation in randomized clinical trials studying mindfulness (Bodenlos et al., 2016). While this held true for the experiments studying mindfulness using psychophysiological measures, the studies on the efficacy of mindfulness with victims of trauma displayed extremely polarizing gender ratios being exclusively (or close to it) male or female in many of the cases listed above. Similarly, the studies of trauma listed above did so exclusively with severe forms of trauma such as PTSD. Although research has been conducted looking at mindfulness interventions with those with non-severe trauma, the author could not find research completed with a randomized clinical trial, and only found correlational and non-clinical experiments. Therefore, research should be conducted on those with low- to moderate- trauma and/or individuals with trauma on the road to recovery. More of this research needs to be conducted using psychophysiological methods due to the current lack of literature on the subject, and the potential benefits that could emerge from it. Recommendations for this research based on the literature above would be: recruit a large, gender-matched, and diverse sample; utilize a randomized clinical trial; measure HRV when individuals are meditating; and eliminate the use of GSR as it is inappropriate based on the findings above and replace it with BP, cortisol, and HRV methodologies.

The research has shown that mindfulness can have profound effects on the experience of victims of trauma, and that psychophysiology is a reliable and objective measure with which to do so. The usefulness of mindfulness, trauma, and psychophysiology lies at

the intersectionality of attention and somatic awareness, forming a potent, but overlooked, combination of study. Although there are current limitations in the quality of the research, such as small and homogenous samples, the findings of trauma reduction are heartening and should be probed further. Hopefully, if the recommendations listed above are accounted for, good quality and reliable research can emerge to enrich the lives of those with this disparaging condition.

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