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An Examination of the Moderators to the Effect of a Brief Mindfulness Intervention for Acute Pain

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Abstract

Mindfulness interventions are becoming used more often in numerous therapy protocols for people suffering from mental illness as well as physical stressors. The current study aims to assess the effectiveness of a brief (15 minute) mindfulness intervention, and its effect on how tolerant participants can become of a cold-pressor task. We aim to look at not only the effectiveness of the treatment itself, but also possible moderators to the effectiveness of said treatment. Two moderators that will be analyzed are general levels of distress intolerance and emotion regulation skills. Our hypothesis firstly will analyze whether or not brief mindfulness interventions can be effective for the participants completing the study. Our second hypothesis is whether or not differing levels of distress intolerance and emotion regulation skills will have an effect on the cold-pressor times. Results indicated that although there was not an effect of mindfulness conditions on the cold-pressor times, emotion regulation skills linked with suppression did however interact with times themselves.

Introduction

Mindfulness Approaches to Therapy

Mindfulness approaches to therapy have arisen due to the increased support for alternative medicine. Mindfulness approaches to disorders often deal with eastern philosophies of body awareness (Chiesa & Melanowski, 2011). The common definition for mindfulness training and therapy is 'paying attention in a particular way, on purpose, in the present moment, and nonjudgmentally' (Kabat-Zinn, 1994). This approach of making people aware of their bodily sensations has influenced many different kinds of therapy used for psychological disorders. Mindfulness has shown to be effective in many clinical settings but has not been fully evaluated as the primary reason that clients have improved.

Mindfulness arises from a Buddhist meditation philosophy, namely that during meditation, one must became aware of the impermanence of their body and that all feelings, pleasant and unpleasant are not permanent (Chiesa & Melanowski, 2011). The tools used for mindfulness are numerous, and as such, mindfulness has not been operationally defined (Chiesa, & Melanowski, 2011). Modern studies have undertaken to operationally define what mindfulness is, as well as the specific techniques that are most beneficial in therapy settings (Chiesa, & Melanowski, 2011). The drawback with having multiple techniques and multiple ways within that technique to administer mindfulness, makes this type of therapy very difficult to generalize to a larger population. A common definition however, and the framework with which our hypothesis is based on, is the idea that mindfulness interventions are meant to bring one's state of mind out of the past (reducing rumination) and future (reducing worry) and into a state of a mind focused on present self-awareness (Chiesa, & Melanowski, 2011).

Mindfulness by itself has also shown to be effective for gains in attentional control. In a February 2012 study, researchers used EEG's to measure attentional control of differing control and mindfulness meditative groups (Moore, Gruber, Derose, & Malinowski, 2012). After a 16 week course of 10 minute per day meditation, participants showed a marked improvement in attentional processing and less effort during object recognition (Moore, Gruber, Derose, & Malinowski, 2012). The implications of this study in relation to chronic pain indicates that even brief mindfulness interventions may allow people to shift their focus away from the source of their pain and into a more beneficial avenue. The ability for one to effectively change their control of attention could also indicate a change in the participant's ability to evaluate and effect their emotions in a similar matter.

Mindfulness training has also shown to be effective as a component in most Cognitive-Behavioral therapies, however, the training itself without other modules of treatment has not been supported. Bishop et. al. (2004) proposed a psychometric property to how mindfulness works within the cognitive literature. They proposed that mindfulness therapy works due to the fact that the client is focusing on sensations in the present, instead of worrying or ruminating on events in the past or future.

A major therapy technique that uses mindfulness and awareness techniques is Acceptance and Commitment Therapy (ACT). ACT focuses specifically on mindfulness and awareness methods, along with behavioral change, all of which have a focus on emotional and cognitive experiences (Hayes et al. 1999). ACT is within the field of Cognitive Behavioral Therapy, but has a pragmatic approach, or client goal-oriented outcome (McCraken & Vowles, 2014). ACT uses mindfulness as a module for the treatment, mainly to increase psychological flexibility within the client. Psychological flexibility is defined as the ability to change or maintain specific

behaviors based on cognitive and non-cognitive influences (McCraken & Vowles, 2014). Using mindfulness to keep a client in the present moment, not focused on past or future worries or anxiety, has been shown as an effective model to deal with chronic pain (McCraken & Vowles, 2014). Unfortunately, most of the outcome results of ACT primarily focus on the psychological side of symptom reduction (anxiety and depression). Research addressing the change in physical or social outcomes of mindfulness interventions is lacking (McCraken & Vowles, 2014).

Mindfulness interventions, although relatively new, has offered another lens with which to view mental health. Present moment awareness and fully experiencing emotional and mental states is the target of mindfulness interventions. Most mindfulness training exercises take many repeated sessions before the participant becomes efficacious, however, the current study will look at whether or not even a brief training in mindfulness can affect the way that people deal with acute pain episodes, and whether or not this brief mindfulness intervention can be generalized and be able to be used in other settings as well.

Emotional Regulation

Emotional regulation is defined as actions that we commit, that influence 'which emotions we have, when we have them, and how we experience and express them' (Gross, 2002). Emotional regulation is normally a set of cognitive or behavioral action responses that aim to alter the type, length, or magnitude of a specific emotion (Cisler, Olatunji, Feldner, & Forsyth, 2009). Emotional regulation is different than emotional reactivity. Emotional regulation can not only be how we respond to a given situation or emotion, but also how we take measures to avoid certain emotionally activating stimuli (Cisler, Olatunji, Feldner, & Forsyth, 2009). Although most literature focuses on emotion regulation and how it relates to anxiety and mental health, this construct may also be applied to physical symptoms of pain. The constructs of

mindfulness and emotion regulation may be related to psychological flexibility. Much like in ACT therapy, psychological flexibility is the ability for a person to either maintain or change behaviors. With emotional regulation, the focus is not necessarily on behaviors, but how we cognitively assess and respond to situation-based emotions.

A framework for emotional regulation also includes two main forms that emotional regulation can take. The first form is the inability of a person to modulate intense emotional feedback (Mennin, Heimberg, Turk, & Fresco, 2002). For instance, someone suffering from acute chronic pain would not be able self-soothe, inhibit or reappraise the feedback. The second form is that when people are confronted with emotionally arousing situations, they then will try to blunt or avoid the situations without fully experiencing them (Mennin, Heimberg, Turk, & Fresco, 2002). Chronic pain is a physiological example of persistent input stimuli, and these two emotion regulation frameworks may explain how people cope. For example, people within the first subset would become overwhelmed due to their inability to inhibit or control their emotions, whereas the second subset would avoid coming to terms and experience the pain in a healthy way. These two forms that emotion regulation has been defined as either regulation or suppression emotional regulation habits, where people that are very good at reappraising can take mental or emotional states and spin them to a more adaptive outcome, whereas those good at suppressing will more likely be able to take a higher rate of unpleasant stimulus.

Emotion regulation as it applies to cognitive processes, usually deals with one's ability to modulate the intensity of ones emotions, as well as appraise the emotions and behaviorally respond to them in a certain way (Zlomke, & Hahn, 2010). One major subset of emotional regulation that is pertinent to the current study is the ability to cognitively manage emotionally threatening or stressful information with conscious cognitive strategies (Thompson, 1991). This

type of cognitive training can be immediately affected by interventions such as mindfulness or other therapy techniques.

Some emotional regulation techniques are automatic but the fact that one can consciously learn techniques to inhibit or accept emotions in the present leads to another framework for the study. Mindfulness therapies, as stated previously, bring one out of the past or future to deal with emotionally arousing stimuli or problems in the present by accepting and being aware that they are there (Kabat-Zinn, 1994). People who rate highly on emotional regulation would be expected to naturally respond better to solely mindfulness interventions, because they are better equipped to deal with present emotions, whereas people who rank lower on emotional regulation would conversely be less able to successfully benefit from mindfulness interventions.

Distress Intolerance

Distress Intolerance (DI) has been a focus for the risk factors of development and maintenance of many psychological disorders (Leyro, Zvolensky, & Bernstein, 2010). Whether it be the inability to deal with emotional distress, a possible construct of borderline personality disorder, or somatic distress, as in the case of substance abusers (Gratz & Gunderson, 2005). Distress Intolerance is already a major target (whether directly or indirectly) of major therapy approaches, such as ACT and other mindfulness based cognitive therapy (Leyro, Zvolensky, & Bernstein, 2010). Using the mindfulness techniques of non-judgmentally accepting and immersing one in a negative state would give those going through the therapy a way to deal with stressful situations. Distress intolerance has been separated into two major distinctions. The first is the persons perceived ability to withstand negative states (whether emotional, psychological, or somatic), and the second being the behavioral act used to withstand the stressor (Leyro, Zvolensky, & Bernstein, 2010).

In the field of anxiety research, DI and emotional regulation contribute to a series of avoidant behaviors, which are maladaptive to living a healthy life. For example, if an individual has a low tolerance for stressful situations, they will develop a regulatory emotional response to avoid or blunt what they perceive as unimaginable trauma (McHugh, Reynolds, Leyro & Otto, 2012). High levels of DI are related to the use and maintenance of automatic stress reduction behaviors (avoidance) (McHugh, Reynolds, Leyro & Otto, 2012). This intolerance, exhibiting as maladaptive avoidant behaviors, then increases the chance of using emotional regulation techniques to replace the maladaptive behaviors (McHugh, Reynolds, Leyro & Otto, 2012). DI may therefore predict emotional regulation techniques commonly employed by people, either positively or negatively.

The ability of those to withstand distressing situations will be the aspect of distress intolerance that we will be analyzing. Mindfulness may offer ways for individuals to heighten their ability to withstand potentially stressful situations, and will be the main aspect of looking at distress intolerance.

Current Study

Mindfulness targets the ability of a person to step out of the past or future and to focus primarily on the present and how they feel. Emotional regulation includes the behaviors and appraisals of emotion, and the actions used to regulate them, by altering the intensity or length of the emotions. DI is the automatic appraisal of stressful situations, and the maladaptive behaviors to avoid those stressors. These two frameworks, as well as the technique that employs alternate forms of each, provide the basis for our research questions. Students will be asked to perform a task to simulate acute pain (a human subject's approved analogue to chronic pain). They will then be administered a mindfulness or relaxation intervention. Based on the framework of

emotional regulation and distress intolerance, individuals are likely to develop their own techniques of stress reduction, often by avoidance of the stressful stimuli, or to decrease the intensity of those feelings. The current study will look at baseline levels of distress intolerance in participants, as well as their success at regulating emotions via the techniques of reappraising or suppressing negative stimuli. These two aspects will be used to gauge whether or not the mindfulness interventions will be effective.

The students will follow a four-step procedure in the completion of this study: 1) completion of a battery of surveys to maintain a baseline, 2) the administration of a cold pressor task, 3) a brief intervention involving one of three experimental groups (Mindfulness, Faux Mindfulness, and Distraction control), and 4) the administration of a second cold pressor task.

Firstly, the student will complete an informed consent, in which the research assistant will walk the participant through step by step and explain explicitly the procedure of the study, and that these students can withdraw from the study at any point without penalty. If they choose to continue the study, the participant will be given an identification number and will continue with the study. The participants will be protected in the study by only using the identification numbers to deindividuate their responses and behavioral task records.

The current study will examine how emotional regulation and distress intolerance can manipulate the effectiveness of the brief mindfulness intervention. Theoretically, participants who score lower on the Emotional Regulation Questionnaire, and higher on the Distress Intolerance Index, will be less receptive to improvement from the brief mindfulness intervention. Conversely, individuals who score higher on the Emotional Regulation Questionnaire and lower on the Distress Intolerance Index will respond better to the brief mindfulness intervention.

Method

Participants

The current study recruited a group of 150 undergraduate students, ages 19 and older, who are attending a large Midwestern university. These students were enrolled in an Introduction to Psychology course, and devoted one to two hours of their time in exchange for course credit.

A medical screening was completed prior to beginning the study to assess the student's eligibility for the study. Responses to the screening questionnaire included questions inquiring to the presence of symptoms related to fainting, heart disease, shortness of breath, frostbite, and Reynaud's Disease. If the student checked 'yes' to any of these options, they were excused from the study, however they still received their compensation points for participating as they are able.

Measures

Demographics Questionnaires

The demographic questionnaire contained questions about a participant's age, gender, educational level, and maternal education level.

Distress Intolerance Index

This index assesses how tolerant of stressful stimuli an individual might be. Scores are given on a five-point Likert scale where 1= very little and 5= very much. Higher scores on this measure indicate that the individual is generally intolerant of aversive and stressful stimuli (McHugh & Otto 2012).

Emotional Regulation Questionnaire

The Emotion Regulation Questionnaire assesses the ability of an individual to regulate the intensity or effect of their emotions on their own behavior. This measure is scored using a seven-point Likert scale with 1= strongly disagree, and 7= strongly agree. There are two specific sub-scales that make up this measure, the first being reappraisal and the second being suppression. Higher scores on these sub-scales would indicate avoidance behaviors of emotions, through either reassigning them cognitively, or blunting the magnitude of them respectively (Gross & Oliver, 2003).

Cold Pressor Apparatus

The cold pressor apparatus was set up in the following circuit: Tank containing antifreeze to cool the water via a closed circuit, two plastic tubing arms (one for input and one for output of the cooling agent), a copper tube connecting the two rubber arms to increase the effectiveness of the cooling agent, a vat of water that the copper tubing was placed in to chill the water that the participants hand was submerged in, and finally a water pump that circulated the chilled water to keep the water a consistent temperature. The water was chilled until it was between 2.5 and 3.5 Celsius as was suggested by other cold pressor studies (Boston & Sharpe, 2005).

Procedure

The water in the cold pressor apparatus was pre-chilled before the participant entered the room. When the participant entered the room, they first were greeted by the experimenter and presented with an informed consent form. The experimenter then walked through the form, describing the purpose of the study, risks to the current study, and possible exclusionary criteria. After the participant had agreed to participate, they then completed a brief medical survey. After

completing the form and after being verified by the experimenter that there was no reason to exclude the participant, they then completed an intake battery consisting of the demographics questionnaire, the Distress Intolerance Index, and the Emotional Regulation Questionnaire. This process took approximately 30 to 45 minutes to complete.

The student then put their hand for approximately two minutes into room temperature water, as was consistent with methods used in other studies (Von Baeyer et al., 2005). After they completed this time period, they were then asked to place their hand up to their wrist in the vat of chilled water, while again reminding them they could remove their hand from the cold water at any point. The experimenter would start a stopwatch as soon as the wrist was submerged, and stop the stopwatch as the hand came out. This process took approximately 5-15 minutes.

The students, who had been randomly assigned before the study began, then partook in one of three experimental conditions: 1) Mindfulness, 2) Faux Mindfulness, or 3) Distraction. The students in the mindfulness condition listened to a 15 minute recording from *Mindfulness Meditation for Pain Relief,* by Jon Kabat-Zinn (2010). This recording first brought attention to the participants breathing, and then goes on to give a brief psychoeducation about mindfulness techniques for pain. Participants in the faux mindfulness condition listened to a 15 minute recording from the same book; however they were only instructed to focus on breathing, without the mindfulness psychoeducation or any attentional cognitive aspects to attending to sensations. Participants in the distraction group listened to a 15 minute recording while completing a series of anagrams. This recording gave the participant techniques on how to solve anagrams (i.e. looking at each individual letter, looking at it backwards etc.). This portion took approximately 20 – 35 minutes.

After the condition specific recording that the participant heard, they then completed another series of questions asking how effective they thought that that condition type would have been for them in dealing with the second cold pressor task. They then submerged their hand up to the wrist in the cold water, however with the stipulation that they should keep the recording that they heard in mind while they had their hand submerged. Once again, the experimenter prompted them before submersion that they could retract their hand at any time.

After the second cold pressor task, the participant completed another battery of surveys, as well as qualitative questions detailing their experience and how they thought they did on the cold-pressor task. They were then debriefed verbally and in writing from the experimenter.

Results

Our sample for this experiment fell into an expected split amongst demographic categorizations (n=150), for a large Midwestern university (See Table 1). The scores being evaluated for moderation of the intervention were the Emotion Regulation Questionnaire (ERQ) Suppression and Reappraisal subscales, which ranged from 4-28 and 6-42 respectively, as well as the Distress Intolerance Index which ranged from 10-50. The average score of ERQ Suppression was 14.91 (SD=5.31), whereas the average score of ERQ Reappraisal was 29.73 (SD=6.31). Distress Intolerance Index (DII) scores were an average of 11.38 (SD=8.22) (See Table 2). Cronbach's alpha for the ERQ was $\alpha = .75$ and for the DII $\alpha = .90$.

	N	Minimum	Maximum	Mean	Std. Deviation
Age:	150	18	28	19.19	1.820
Years of School:	150	1	12	1.87	1.740

Ethnicity	Frequency	Percent	Valid Percent	Cumulative Percent
American Indian or Alaska Native	3	2.0	2.0	2.0
Asian	13	8.7	8.7	10.7
Black or African American	50	33.3	33.3	44.0
Latino(a) or Hispanic	20	13.3	13.3	57.3
White or European American	64	42.7	42.7	100.0

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	79	52.7	52.7	52.7
Male	71	47.3	47.3	100.0
Total	150	100.0	100.0	

Table 1: Demographic information

	N	Minimum	Maximum	Mean	Std. Deviation
DII_Total	150	0.00	39.00	11.3800	8.21822
ERQ_Reappraisal	150	6.00	42.00	29.7333	6.43779
ERQ_Suppression	150	4.00	26.00	14.9133	5.31294

Table 2: Descriptive scores of measures being analyzed.

Two sets of analyses were conducted. First, a mixed design ANOVA was conducted, with cold-pressor task times (CPTtimes) as the within subjects factos and the between subject factor being condition number and ERQ –Suppression (ERQ_S), ERQ-Reappraisal (ERQ_R), and DII scores as covariates. After the first set of analyses, a separate repeated measures ANOVA was conducted splitting the ERQ_S into high and low groupings to examine if there was a main effect on the CPTtimes.

The effect of condition number on CPTtimes was nonsignificant, Pillai's Trace = .00, $F(1, 144) = .74$, $p=.48$ (See Table 3). However, a significant interaction was found between the independent variable ERQ_S (emotion regulation, suppression subscale) and CPTtimes, Pillai's Trace = .04, $F(1, 146) = 6.35$, $p=01$. There were no main effects found for CPTtimes or condition number. A secondary analysis was run to further examine the interaction found between ERQ_S scores and CPTtimes.

Effect		Value	F	Hypothesis df	Error df	Sig.
CPTtimes	Pillai's Trace	.01	.84[b]	1.00	146.00	.36
	Wilks' Lambda	.99	.84[b]	1.00	146.00	.36
	Hotelling's Trace	.01	.84[b]	1.00	146.00	.36
	Roy's Largest Root	.01	.84[b]	1.00	146.00	.36
CPTtimes * DII_Total	Pillai's Trace	.00	.48[b]	1.00	146.00	.49
	Wilks' Lambda	.99	.48[b]	1.00	146.00	.49
	Hotelling's Trace	.00	.48[b]	1.00	146.00	.49
	Roy's Largest Root	.00	.48[b]	1.00	146.00	.49
CPTtimes * ERQ_Reappraisal	Pillai's Trace	.00	.18[b]	1.00	146.00	.67
	Wilks' Lambda	.99	.18[b]	1.00	146.00	.67
	Hotelling's Trace	.00	.18[b]	1.00	146.00	.67
	Roy's Largest Root	.00	.18[b]	1.00	146.00	.67
CPTtimes * ERQ_Suppression	Pillai's Trace	.04	6.35[b]	1.00	146.00	.01
	Wilks' Lambda	.96	6.35[b]	1.00	146.00	.01
	Hotelling's Trace	.04	6.35[b]	1.00	146.00	.01
	Roy's Largest Root	.04	6.35[b]	1.00	146.00	.01

Table 3. Repeated measure ANOVA ran for CPTtimes, condition number, and interactions of ERQ and DII scores

To determine the nature of the interaction between ERQ_S and CPTtimes, participants were split into two groups based on a median split of ERQ_S scores. A High ERQ_S included anyone scoring 15 and above on the subscale, while the Low ERQ_S was anyone below 15. A separate repeated measures ANOVA was conducted to examine the effect of group on the CPTtimes. A significant within subjects effect for CPTtimes was found, $F(1, 76) = 7.40$, $p< .01$,

for the High ERQ_S group, as well as Low ERQ_S group, $F(1, 72) = 16.08$, $p<.001$ (See Table 4).

ERQ_Suppression (Binned)			Type III Sum of Squares	df	Mean Square	F	Sig.
LOW_ERQ_S	CPTtimes	Sphericity Assumed	6433.39	1	6433.39	7.40	.01
		Greenhouse-Geisser	6433.39	1.00	6433.39	7.40	.01
		Huynh-Feldt	6433.39	1.00	6433.39	7.40	.01
		Lower-bound	6433.39	1.00	6433.39	7.40	.01
	Error(CPTtimes)	Sphericity Assumed	66039.20	76	868.94		
		Greenhouse-Geisser	66039.20	76.00	868.94		
		Huynh-Feldt	66039.20	76.00	868.94		
		Lower-bound	66039.20	76.00	868.94		
HIGH_ERQ_S	CPTtimes	Sphericity Assumed	32601.47	1	32601.47	16.08	.00
		Greenhouse-Geisser	32601.47	1.00	32601.47	16.08	.00
		Huynh-Feldt	32601.47	1.00	32601.47	16.08	.00
		Lower-bound	32601.47	1.00	32601.47	16.08	.00
	Error(CPTtimes)	Sphericity Assumed	145963.50	72	2027.27		
		Greenhouse-Geisser	145963.50	72.00	2027.27		
		Huynh-Feldt	145963.50	72.00	2027.27		
		Lower-bound	145963.50	72.00	2027.27		

Table 4: a Repeated measures ANOVA was conducted to see an effect on CPTtimes between High and Low ERQ_S groups.

Due to the previous results, further independent sample t-tests were conducted to compare CPTtimes in High ERQ_S conditions and Low ERQ_S conditions. There was a

significant difference in the CPTtimes at time 1 for Low ERQ_S (*M*=71.56, *SD*=90.78) and High ERQ_S (*M*=117.47, *SD*=112.31) groups; *t*(148)=-2.76, *p*=.01. There was also a significant difference in CPTtimes at time 2 for Low ERQ_S (*M*=84.49, *SD*=92.36) and High ERQ_S (*M*=147.35, *SD*=119.06) groups; *t*(148)=-3.62, *p*=.00 (See Table 5).

ERQ_Suppression		N	Mean	Std. Deviation	Std. Error Mean
CPT #1 Video Time (seconds)	Low ERQ_S	77	71.56	90.78	10.35
	High ERQ_S	73	117.47	112.31	13.14
CPT #2 Video Time (seconds)	Low ERQ_S	77	84.49	92.36	10.53
	High ERQ_S	73	147.35	119.06	13.93

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
CPT #1 Video Time (seconds)	Equal variances assumed	11.01	.00	-2.76	148	.01	-45.91	16.63	-78.78	-13.04
	Equal variances not assumed			-2.74	138.49	.01	-45.91	16.73	-78.92	-12.83
CPT #2 Video Time (seconds)	Equal variances assumed	19.81	.00	-3.62	148	.00	-62.87	17.35	-97.15	-28.59
	Equal variances not assumed			-3.60	135.74	.00	-62.87	17.46	-97.40	-28.33

Table 5*:* independent sample t-tests conducted to compare the means between High and Low ERQ_S groups.

Discussion

The purpose of the study was twofold. The first hypothesis posited that a brief mindfulness intervention would have an effect on the ability of participants to withstand a cold-pressor acute pain task. The second hypothesis stated that levels of emotion regulation and

distress intolerance would subsequently moderate the effectiveness of the mindfulness intervention.

Prior to the experiment, we believed that emotion regulation skills and distress intolerance would have an effect on CPT times between times one and times two, namely that those that scored low on emotion regulation would not be able to fully implement the mindfulness recording and have a significant difference in their CPT times, whereas those that scored high on the DII would follow the same pattern of inability to implement mindfulness training.

The primary analysis, determining whether the condition the participants were in had an effect on CPTtimes, yielded nonsignificant results. This would indicate that regardless of the condition that individuals were a part of (ie. mindfulness, faux mindfulness, and distraction), there was no difference in the CPTtimes. We did find however that ERQ_Suppression had an interaction with the CPTtimes.

The primary analysis showed that mindfulness had no effect on the participant's ability to withstand the CPT. This evidence, although discouraging, can be accounted for by many factors. The design of the experiment only allowed a brief mindfulness intervention, only 15 minutes. Fifteen minutes of re-training 18-20 years of emotion regulation may not have been enough to allow participants to fully learn and implement mindfulness. Those that go through mindfulness training and therapy will often have many weeks to fully learn and be able to effectively integrate being mindful, especially when encountering stressful situations.

After identifying the interaction, the second analysis showed that there was an effect of CPTtimes in regards to scores that individuals reported on the ERQ_Suppression. This went both

ways, either those scoring high in suppression or low in suppression skills had an effect of time. The effect for CPTtimes, when further analyzed, showed that participants could withstand the cold pressor task longer the second time. This indicates that whether or not individuals were highly predisposed to suppressing unpleasant stimuli, or not effective at suppressing unpleasant stimuli, they were still able to improve the time they could withstand the acute pain task from the first cold pressor task to the second. To further analyze the interaction, two independent sample T-tests were done to identify if the means times that each group could withstand the cold-pressor task were significantly different. We found that there was a significant difference at both cold pressor times at trials one and two for the ERQ_Suppression groups. Those that scored high on Suppression were able to withstand the cold pressor task longer at times one and two than those that scored lower on suppression. To sum, participants were able to withstand the acute pain task during the second trial better than the first, and those that scored high on the suppression subscale of the ERQ were able to withstand the task better at both times one and two than those that scored low on the same subscale.

Although the primary hypothesis, that mindfulness would lead to a significant effect of CPTtimes was not significant, we did find that the ability for individuals to suppress their emotions did lead to a significant interaction. We can use this information, in the confines of our study and the acute pain task in a way that suggests suppressing unpleasant emotions had a more significant effect on CPTtimes then did the intervention. We can further state that within the context of acute pain scenarios, those with little to no training in mindfulness will rely more heavily on suppressing those negative physical sensations, and that those that are more effective at suppression will do better at withstanding unpleasant pain stimuli than those that are not.

This study had many strengths that offer another lens through which to understand acute pain, mindfulness, and distress intolerance. Many other studies use a much longer mindfulness training period. This study only used a brief intervention, indicating that one cannot change an entire lifetime of thought processes and natural regulation styles in fifteen minutes. The individual personality differences (natural tendencies to suppress unpleasantness in this case) that individuals came into the study with caused a larger effect than mindfulness, showing that upon entering an intervention setting (either research, therapy etc.) differing personality variables should be taken into account before continuing upon a specific course of action.

Although the experiment had many strengths, there are possible limitations that should be addressed and analyzed for future projects. Firstly, we used an undergraduate sample instead of a clinical sample. A clinical sample should have vastly different scores on emotion regulation and distress intolerance and these differences may be able to let us further identify the moderating effects of emotion regulation and distress intolerance. Another avenue for future directions would be to increase the length of time of the intervention. A 15 minute intervention did not have significant effect here, however, mindfulness in general has shown to be effective in the general field for therapeutic techniques.

Due to the briefness of the intervention, future directions into the effectiveness of mindfulness should use longer interventions and evaluate the effect of a longer, more intensive mindfulness intervention. Future directions could also include use of a sample of individuals already suffering from chronic pain, or attending mindfulness training for a much longer period of time. Another direction is to use emotion regulation as a possible facet of cognitive-behavioral therapies, using adaptive emotion skills as a possible indirect target for pathological disorders or acute pain issues.

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