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Mindfulness Is Associated with Increased Hedonic Capacity Among Chronic Pain Patients Receiving Extended Opioid Pharmacotherapy

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Abstract

Objectives—Chronic pain and long-term opioid use may lead to a persistent deficit in hedonic capacity, characterized by increased sensitivity to aversive states and insensitivity to natural rewards. Dispositional mindfulness has been linked with improved emotion regulation and pain coping. The aim of the current study was to examine associations between dispositional mindfulness, hedonic capacity, and pain-related interference in an opioid-using chronic pain sample.

Methods—Data were obtained from a sample of 115 chronic pain patients on long-term opioid therapy (68% females, M age=48.3, SD=13.6) who completed the Five Facet Mindfulness Questionnaire (FFMQ), the Snaith Hamilton Anhedonia and Pleasure Scale (SHAPS), the Brief Pain Inventory (BPI), and a psychiatric assessment of major depression. Bivariate correlations, hierarchical multiple regression, and path analysis were used to determine if dispositional mindfulness scores (FFMQ) predicted variance in hedonic capacity (SHAPS), and if hedonic capacity mediated the association between mindfulness and pain interference.

Results—We observed a significant positive correlation between dispositional mindfulness and hedonic capacity scores, $r=.33$, $p<.001$. Hierarchical regression indicated that after controlling for pain interference and major depressive disorder diagnosis, dispositional mindfulness explained a significant portion of variance in hedonic capacity (Beta = .30, $p<.01$). The association between dispositional mindfulness and pain interference was mediated by hedonic capacity ($b = -.011$, $SE=.005$, 95% C.I. = $-.004$ to $-.024$, full model $R^2=.39$).

Discussion—Findings indicate that dispositional mindfulness was associated with hedonic capacity among this chronic pain sample. In light of this association, it is plausible that interventions that increase mindfulness may reduce pain-related impairment among opioid-using patients by enhancing hedonic capacity.

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Keywords

mindfulness; chronic pain; hedonic capacity; anhedonia

1. Introduction

A growing body of scientific evidence suggests interactions between pain and affective pathways.¹ Prevalence rates of depression among chronic pain patients in the U.S. range between 30–60%,^{2,3} which is orders of magnitude greater than the 6.7% prevalence rate of major depression among the general population.^{4,5} And while opioids are commonly used to treat chronic pain conditions,⁶ with over 4 million Americans prescribed opioids per year,⁷ studies suggest that chronic pain patients who use or misuse long-term opioid analgesics are more vulnerable to depressive symptoms than chronic pain patients who do not take opioids.^{8–11} Though sadness and mild mood alterations are normal and expected reactions to pain, it is not yet fully known why some chronic pain patients on extended opioid therapy progress from these normative affective reactions to the clinically significant attenuation of hedonic capacity (i.e., anhedonia) which is the hallmark of depression. Hedonic capacity refers to the ability to experience pleasure and reward from pleasant stimuli.¹² This capacity may be undermined by the independent and interactive effects of chronic pain and extended opioid therapy, which are thought to produce anhedonia through neuropsychopharmacologic mechanisms.¹³

Irrespective of the anhedonic effects of chronic opioid exposure, reduced hedonic capacity has been observed among pain patients for decades.^{14–17} This phenomena may be explained from a cognitive perspective: a body of evidence suggests that pain (like other aversive experiences and negative emotional states) can narrow and tune attention towards present harms and potential threats.¹⁸ This negative attentional bias, while evolutionarily conserved for its survival value, may result in a kind of “cognitive myopia”, preventing the individual from noticing and appreciating pleasant events and experiences.¹⁹ In that regard, both hypervigilance and pain catastrophizing involve a narrowed attentional and cognitive focus that may reduce hedonic well-being.^{20–22}

From a behavioral perspective, the development of anhedonia among individuals with chronic pain has been attributed in part to reduced motivation to undertake goal-directed actions.²³ This can be an adaptive functional response to acute pain as it can both facilitate the healing process and reduce the likelihood of future injury through instantiating avoidance behaviors.^{24,25} However, in the case of chronic pain, continued reduced motivation to engage in reward-seeking behavior becomes a major source of morbidity. This process may partially explicate how chronic pain may come to interfere with everyday life functioning (i.e., pain interference). Of course, reduced awareness of pleasant experiences and diminished motivation to engage in pleasurable behaviors can fuel one another. Gandhi, Becker and Schweinhardt²⁶ found that among a sample of healthy adults exposed to experimental heat pain stimulation, participants attempted to compensate for pain-induced negative affect through increased engagement in reward seeking behavior which did not result in hedonic pleasure – thus, acute pain is associated with an increase in motivational

drive to obtain reward coupled with no increases in reward responses or reward liking. When sustained over time, Becker, Kleinböhl, and Hölzl²⁷ theorize that this inability to obtain pleasure through approach behaviors, coupled with implicit operant conditioning as a result of pain exposure, might explain increases in motivational drive in response to acute pain and decreases in approach behaviors and reward responsiveness over time when pain becomes chronic. As pain becomes chronic and reward-seeking behaviors become less frequent, opportunities to experience pleasure are minimized.

In contradistinction to this hedonic vulnerability, dispositional mindfulness has recently emerged as an important individual difference for understanding resilience in the context of chronic pain. Dispositional mindfulness refers to the propensity to express mindful qualities in everyday life, such as nonjudgment, nonreactivity, and awareness of internal and external stimuli.^{28,29} Dispositional mindfulness differs from state mindfulness in that it is an enduring characteristic or trait, as opposed to a transitory state of awareness produced by the practice of mindfulness meditation.³⁰ As a trait, mindfulness is roughly normally distributed among healthy individuals.³¹ Thus, people vary in the extent to which they exhibit dispositional mindfulness, yet this dispositionality can be strengthened through training - individuals who participate in mindfulness-based interventions evidence increases in dispositional mindfulness, which mediates the effects of training on clinical outcomes.³²

A growing body of research has investigated the effects of state mindfulness and mindfulness practice on the experience of chronic pain.^{33,34} However, surprisingly little research has explored the relationship between dispositional mindfulness and chronic pain. This line of investigation could potentially explain varying resiliencies among pain patients and might help elucidate individual treatment needs. A few of the studies that have been conducted have focused on dispositional mindfulness and pain catastrophizing, including research in a healthy undergraduate sample that identified a significant negative correlation between dispositional mindfulness and pain catastrophizing.³⁵ Other studies of adult chronic pain samples indicate that dispositional mindfulness is inversely associated with pain-related functional disability,³⁶ and this relationship may be mediated by decreased catastrophizing among individuals reporting higher levels of mindfulness.³⁷ Additional research demonstrates that dispositional mindfulness mediates the relationship between pain severity and pain-related impairment, such that individuals experiencing higher levels of pain severity were less mindful than those reporting less pain severity, which explained the greater levels of pain-related impairment among individuals with severe pain.³⁸ Similar findings have also been replicated in adolescent samples demonstrating that dispositional mindfulness inversely predicts pain interference with daily life activities.³⁹ As further evidence of the importance of this construct to understanding chronic pain, increasing dispositional mindfulness through mindfulness training and other interventions has been shown to be associated with improvements in chronic pain severity,⁴⁰ pain-related disability,³⁸ and quality of life⁴¹ in clinical samples.

Recent theorizing suggests that the practice of mindfulness may be linked with increased hedonic capacity and responsiveness to natural reward,⁴² and randomized controlled studies suggest that this in fact the case. Geschwind et al. found that Mindfulness-Based Cognitive Therapy enhanced self-reports of reward experience among a sample of patients with a

history of depression.⁴³ Similarly, Garland et al. found that a Mindfulness-Oriented Recovery Enhancement intervention increased cardiac-autonomic and electrocortical indices of natural reward processing among a sample of opioid using chronic pain patients.^{44,45} If mindfulness practice (which has been shown to increase mindful dispositional) can augment reward experience, it stands to reason that dispositional mindfulness might be positively associated with hedonic capacity. Yet, this relation has not been assessed in the literature. Furthermore, given the buffering effects of dispositional mindfulness on pain-related impairment, and linkages between anhedonia and the effects of pain on motivated behavior, mindfulness might be related to attenuated pain-related interference through its association with enhanced hedonic capacity. In light of this theoretical and empirical basis, the aim of the present study was to examine associations between dispositional mindfulness, hedonic capacity, and pain-related interference in a chronic pain sample comprised of individuals receiving extended opioid analgesic treatment, with and without comorbid major depressive disorder. Due to their putatively heightened susceptibility to anhedonia,⁸ the present investigation was focused on opioid-using pain patients. We hypothesized that: 1) dispositional mindfulness would be significantly positively associated with hedonic capacity and inversely associated with pain-related interference; 2) hedonic capacity would be inversely associated with pain-related interference; and 3) the relation between dispositional mindfulness and pain-related interference will be significantly mediated by hedonic capacity.

2. Materials and Methods

2.1 Participants

Participants with a wide range of chronic pain conditions (low back pain, cervical pain, joint pain, and fibromyalgia) were recruited between 2011–2012 from primary care clinics, pain clinics, and neurology clinics in Tallahassee, Florida through flyers and online classified ads. Inclusion criteria required that participants reported chronic non-cancer-related pain and had been prescribed and were taking opioids for analgesia at least five days a week for the past 90 days or more.⁴⁶ Participants were excluded if they were actively suicidal or psychotic, which was assessed with the Mini-International Neuropsychiatric Interview 6.0 (MINI).⁴⁷

2.1 Procedure

The institutional review board and Human Subjects Committee at Florida State University (where the last author was located at the time of data collection) reviewed and approved the study prior to participant recruitment. Following psychiatric screening, participants who met eligibility requirements and consented to participate in the study voluntarily completed a packet of validated self-report measures that captured demographic and clinical information. All participants were paid \$25 for completing the study protocol.

2.2 Measures

2.3.1. Dispositional Mindfulness—Mindfulness was measured with the 39-item Five Facet Mindfulness Questionnaire (FFMQ) ($\alpha = .78$ in the current study).²⁸ This instrument includes five subscales tapping distinct facets of mindfulness including: observing internal and external experience; describing emotions with words; acting with awareness; non-

judging of inner experience; and non-reactivity to inner experience. Items are rated on a 5-point Likert-type scale ranging from 1 (never or very rarely true) to 5 (very often or always true). A total dispositional mindfulness score is computed by summing all the items. The FFMQ was selected on the basis of both the conceptual framework of mindfulness upon which it was constructed (i.e. a multi-faceted conception) and its ability to maximally capture the most factors and measure them individually. The FFMQ was generated through an exploratory factor analysis of a combined pool of items from five validated mindfulness scales (e.g., Mindful Attention Awareness Scale (MAAS),⁴⁸ the Freiburg Mindfulness Inventory (FMI),³¹ the Kentucky Inventory of Mindfulness Skills (KIMS),⁴⁹ etc.), and then validated through hierarchical confirmatory factor analysis, which demonstrated significant convergent and discriminant validity. As such, the FFMQ is presently one of the most inclusive and comprehensive assessments of mindfulness.

2.3.2. Hedonic Capacity—Participants completed the Snaith-Hamilton Anhedonia and Pleasure Scale (SHAPS; $\alpha = .78$ in the current study),⁵⁰ which measures hedonic capacity with 14 items tapping the pleasure experienced from a variety of natural rewards (e.g., being with family, a warm bath, smiling faces, a beautiful landscape, receiving praise). There are four response categories ranging from 1 (strongly disagree) to 4 (strongly agree). These items are summed to produce a total score; higher SHAPS scores indicate higher levels of hedonic capacity.

2.3.3. Pain Severity—A four-item subscale of the Brief Pain Inventory ($\alpha = .87$ in the current study),⁵¹ was used to measure pain severity. The BPI is a well-validated and widely used measure of chronic pain.⁵¹ Participants reported their current pain, as well as their worst, least, and average pain over the past week. Response options range from 0 (no pain) to 10 (pain as bad as I can imagine), and an overall pain severity score is computed by taking the mean of the four items.

2.3.4. Pain Interference—A separate subscale of the BPI ($\alpha = .88$ in the current study) was used to assess pain-related functional interference. This seven-item subscale measures the level of interference with function caused by pain in general activity, mood, walking ability, normal work, relations with other persons, sleep and enjoyment of life. Scores range from 0 (no interference) to 10 (complete interference) for each item and are then scored by computing the mean of the seven items.

2.3.5. Major Depressive Disorder—The MINI⁴⁷ was used by trained, graduate-level clinical social workers to determine whether participants met DSM-IV-TR criteria for a current diagnosis of major depressive disorder.

2.3 Statistical analysis

To test study hypotheses, we conducted a series of Pearson bivariate correlations in order to examine bivariate relationships between multiple variables, including dispositional mindfulness, measured with the overall FFMQ scores, hedonic capacity, measured by the total SHAPS scores, and pain severity and interference both measured with the BPI. Because any observed association between dispositional mindfulness and hedonic capacity might be

spurious (due the possibility that individuals with lower levels of pain and depression might coincidentally report greater mindfulness and increased hedonic capacity), we then conducted a hierarchical multiple regression analysis to explore dispositional mindfulness (FFMQ) as a predictor of hedonic capacity (SHAPS) in Step 2 controlling for potential confounding variables in Step 1 (pain severity and interference, major depressive disorder diagnosis).

Finally, in order to explore whether hedonic capacity (SHAPS) mediated the relationship between dispositional mindfulness and pain-related interference after controlling for confounders including major depressive disorder diagnosis and pain severity, statistical mediation was tested in the SPSS PROCESS 2.13 macro with bootstrapping procedures.⁵² In this model, total FFMQ scores were used as the independent variable, SHAPS scores were used as mediator, and BPI pain interference scores were used as the dependent variable. Unstandardized indirect effects were computed for each of 1,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. Significance of the indirect effect was indicated by the upper and lower limits of the 95% confidence interval not spanning zero. This method has been recommended as superior to a normal theory approach to testing mediation (e.g., Sobel test) because it does not assume normality of the indirect effect sampling distribution.

3. Results

Clinical characteristics

Data were obtained from a sample of 115 chronic pain patients on long-term opioid therapy (37 males and 78 females) ranging in age from 20–84 years ($M=48.3$, $SD=13.6$). Table 1 depicts participant demographics and clinical characteristics. On average, participants reported that they had experienced chronic pain for 11.2 (SD, 10.1) years, and that their most prevalent pain diagnoses were low back pain (56.5%), fibromyalgia (20.0%), joint pain (7.0%), upper back/neck pain (6.0%), and “other” pain conditions (10.4%). Nearly two-thirds of participants met diagnostic criteria for major depressive disorder ($n=69$), according to the MINI. Individuals meeting diagnostic criteria for depression reported significantly lower dispositional mindfulness ($t=3.49$, $p=.001$) and hedonic capacity scores ($t=2.33$, $p=.02$), and significantly higher pain interference scores ($t=4.18$, $p<.001$) than individuals without a depression diagnosis, but did not significantly differ in pain severity.

Zero-order correlations

Consistent with hypotheses 1, we observed a significant positive correlation between dispositional mindfulness (FFMQ) and hedonic capacity (SHAPS), $r=.33$, $p<.001$. At the facet level, three of the FFMQ facets were significantly correlated with hedonic capacity: observing inner experience, non-judgment, and acting with awareness (see Table 2). Dispositional mindfulness was also significantly negatively correlated with pain-related interference, $r=-.27$, $p<.01$. Consistent with hypothesis 2, we observed a significant negative correlation between hedonic capacity and pain-related interference, $r=-.22$, $p<.01$. Correlations are reported in Table 2.

Regression analysis

A hierarchical multiple regression analysis (see Table 3) was conducted in order to determine if dispositional mindfulness could predict variance in hedonic capacity, above and beyond potential confounding variables, including pain severity, pain interference, and major depressive disorder diagnosis. In the first step, only pain interference was significantly associated with hedonic capacity ($Beta = -.29, p = .018$). In the second step, dispositional mindfulness ($Beta = .30, p = .003$) explained an additional portion of variance in hedonic capacity ($F_{change} = 9.16, p = .003$) above and beyond the set of covariates in step 1 (model $R^2 = .21$).

Mediation analysis

The mediation analysis testing hypothesis 3 (see Figure 1) found the regression coefficient between dispositional mindfulness and hedonic capacity to be statistically significant (the *a* path: $B = .14, SE = .04, p = .005$), as was the regression coefficient between hedonic capacity levels and pain interference scores (the *b* path: $B = -.07, SE = .02, p = .006$). The direct effect of dispositional mindfulness on pain interference (the *c* path: $B = -.035, SE = .01, p = .005$) was reduced (the *c'* path: $B = -.02, SE = .01, p = .06$) after controlling for hedonic capacity, suggesting the presence of mediation. The bootstrapped unstandardized indirect effect was $-.011$ ($SE = .005$), and the 95% confidence interval ranged from $-.004$ to $-.024$ which did not span zero. The bootstrapped indirect effect remained significant even after controlling for confounders including pain severity and major depressive disorder diagnosis (full model $R^2 = .39$). Thus, the indirect effect of hedonic capacity on pain interference was statistically significant.

4. Discussion

Current study findings indicate that among a sample of opioid-using chronic pain patients, dispositional mindfulness was positively associated with hedonic capacity and negatively associated with pain-related interference. Though the magnitude of the observed associations was modest, mindfulness remained a significant predictor of hedonic capacity even after for controlling clinically relevant confounders, including presence of major depressive disorder diagnosis and chronic pain severity. Moreover, the inverse association between dispositional mindfulness and pain-related interference was statistically mediated by hedonic capacity, such that mindful individuals experienced less functional interference from pain by virtue of their greater responsiveness to natural rewards. To our knowledge, this is the first indication in the scientific literature of an association between dispositional mindfulness and hedonic capacity among chronic pain patients on extended opioid pharmacotherapy. Given the clinical relevance of anhedonia in chronic pain, these preliminary data may help to elucidate individual differences in resiliencies that might be targeted by interventions in order to enhance hedonic regulation and improve outcomes.

Prior research suggests that maladaptive psychological processes counter to dispositional mindfulness, such as hypervigilance and pain catastrophizing, can amplify functional interference and reduce engagement in valued living activities, thereby depriving the individual of hedonic well-being.⁵³ Conversely, current study findings suggest that

dispositional mindfulness is associated with heightened hedonic capacity, perhaps due to the characteristic broadened awareness and increased observation of sensory experiences that it entails. By increasing hedonic well-being, dispositional mindfulness may broaden the scope of cognition and behavior to increase engagement in valued activities and engender resilience in the presence of pain.⁵⁴ In that regard, we observed less pain-related functional interference, as evidenced by increased engagement in work, social relationships, and enjoyment of life, among individuals with high levels of dispositional mindfulness and hedonic capacity in this sample.

These results may be illuminated by the body of neuroscientific evidence indicating that chronic pain reduces hedonic capacity and reward responsiveness over time by modifying brain structure and function.⁵⁵ Theory suggests that this transition may occur following prolonged exposure to unrelenting pain as a result of allostatic load, that is, the deterioration of hedonic regulatory brain systems from chronic, pain-induced stress.⁵⁶ This process may lead to a persistent hedonic deficit,⁵⁷ characterized by increased sensitivity to stress and pain and insensitivity to reward⁵⁸ that is paralleled by alterations in mesocorticolimbic reward circuitry.^{59–63} These neurobiological changes may reflect a dispositional inability to experience reward from pleasant objects and events. Insensitivity to natural rewards among chronic pain patients may be further exacerbated by chronic exposure to opioids, which can induce allostatic changes to brain reward systems,⁶⁴ with concomitant reductions in autonomic and attentional responses to natural reward stimuli.⁶⁵ Though neuroimaging studies demonstrate that trait reward responsiveness predicts opioid analgesia,⁶⁶ it remains to be seen whether individual differences in dispositional mindfulness are, like other personality traits, associated with brain reward system function and endogenous opioid activation during pain regulation.⁶⁷

To be clear, mindfulness involves awareness and acceptance of present-moment experience, whether pleasant or painful. In that regard, prior studies have demonstrated that mindful acceptance can alleviate pain and improve coping.⁶⁸ It is likely that the association between dispositional mindfulness and pain interference might be mediated by acceptance in addition to hedonic capacity. Indeed, resilience may require the patient to accept pain while at the same time acknowledging and appreciating pleasant everyday experiences, in spite of bodily discomfort – this complex, adaptive process may ultimately result in personal growth in response to chronic pain.⁶⁹ Unfortunately, we did not collect data on pain acceptance in the present study. Future studies should examine both potential mediational pathways to explicate the ways in which mindful dispositional might buffer individuals from pain-related functional impairment.

While the present study provides initial evidence for the role of dispositional mindfulness in hedonic capacity and pain-related interference, there are several limitations to these findings. First, due to the cross-sectional nature of the design, it is impossible to make any causal inferences regarding the directionality of relationships among mindfulness, hedonic capacity, and pain-related interference. Longitudinal research will provide a more rigorous means of elucidating causal ordering of the relationships examined in this study. Also, data were obtained through self-report measures, which are subject to social desirability biases and may only capture a portion of the variance among constructs of interest. Additionally,

because all participants were receiving extended opioid pharmacotherapy, the generalizability of the results may be limited to chronic pain patients who have been prescribed opioids. Furthermore, though meeting diagnostic criteria for depression was not a study inclusion criterion, the sample had a high rate of depression, which might have also affected the generalizability of study findings. Studies have shown that the prevalence of depression among chronic pain patients ranges from 4 to 66%⁷⁰; the prevalence of depression in our chronic pain sample approached the upper end of this range. Dispositional mindfulness and hedonic capacity might exhibit different relations with pain-related interference in samples with lower rates of depression. In the future, larger scale studies of opioid-naïve and opioid-treated chronic pain patients should employ psychophysiological paradigms to assess reward responsiveness and its association with self-reported dispositional mindfulness in the context of experimental pain challenges, with a specific focus on the dopaminergic and opioidergic correlates of this association.

Although this study was primarily focused on dispositional mindfulness, randomized controlled trials suggest that mindfulness training may enhance reward responsiveness among chronic pain patients^{44,45} and positive affective processes more generally.^{43,71} Research has also demonstrated that mindfulness training can lead to enduring changes in dispositional mindfulness,³² which might mediate the effects of mindfulness-based interventions on reward responsiveness. In light of the observed association between mindfulness and hedonic capacity in the present study, it is plausible that mindfulness training may improve chronic pain and related affective symptoms by enhancing hedonic well-being. To test this hypothesis, future clinical trials could assess the effects of mindfulness training on biobehavioral and self-report measures of hedonic capacity.

In conclusion, in this sample of chronic pain patients, anhedonia was correlated with pain-related interference, whereas dispositional mindfulness, and specifically the capacity to observe internal and external experience, buffered against such interference by virtue of its association with greater hedonic capacity. These findings, while preliminary, suggest that enhancing mindfulness may be an important target of interventions aimed at reducing both anhedonia and pain-related interference among individuals suffering from chronic pain.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Multivariate path model testing the mediating role of hedonic capacity between dispositional mindfulness and pain-related interference. Unstandardized path coefficients are shown next to arrows indicating each link in the analysis, with SEs in parentheses. The indirect effect through hedonic capacity (represented by the arrow under that variable in the figure) was statistically significant, as the 95% confidence interval did not span zero.

Table 1

Demographic and Clinical Characteristics of the Chronic Pain Sample (N = 115).

Measure	
Female, N (%)	78 (68%)
Age	48.3 ± 13.6
Work status, full time, N (%)	29 (26%)
Race	
Not respond	11 (10%)
American Indian	4 (3%)
African American	21 (18%)
Caucasian	75 (65%)
Other	4 (3%)
Income level	
Not respond	34 (30%)
Below \$20,000	27 (23%)
\$20,000–\$39,999	27 (23%)
\$40,000–\$59,999	10 (9%)
\$60,000–\$79,999	9 (8%)
Over \$80,000	8 (7%)
Education, some college, N (%)	81 (70%)
Primary pain condition, N (%)	
Low Back	65 (57%)
Fibromyalgia	23 (20%)
Joint Pain	8 (7%)
Cervical Pain	7 (6%)
Other	12 (10%)
Duration of chronic pain (years)	11.2 ± 10.1
Pain severity (BPI)	5.5 ± 1.5
Pain interference (BPI)	6.1 ± 2.1
Major depressive disorder dx, N%	69 (60%)

Table 1

Zero-order correlations between study variables (N = 115).

	SHAPS Hedonic Capacity	FFMQ Dispositional Mindfulness	BPI Pain Severity	BPI Pain Interference	MDD DX	FFMQ Non- React	FFMQ Describe	FFMQ Observe	FFMQ Non- Judge	FFMQ Aware
SHAPS	1									
FFMQ	.33***	1								
BPI Pain Severity	-.20*	-.12	1							
BPI Pain Interference	-.30**	-.27**	.49***	1						
MDD DX	-.23*	-.34**	.18	.39***	1					
FFMQ Non-React	.13	.49***	-.15	-.13	-.03	1				
FFMQ Describe	.15	.71***	-.12	-.10	-.25*	.29**	1			
FFMQ Observe	.19*	.32**	.07	.13	.32**	.46***	.12	1		
FFMQ Non-Judge	.21*	.51***	.04	-.31**	-.50***	-.23*	.28**	-.35***	1	
FFMQ Aware	.20*	.62***	-.15	-.33***	-.39***	-.04	.29**	-.29**	.55***	1

Note.

*
 $p < .05$.**
 $p < .01$.***
 $p < .001$.SHAPS = Snaith-Hamilton Anhedonia and Pleasure Scale.⁴¹ FFMQ = Five Facet Mindfulness Questionnaire.²⁵ BPI = Brief Pain Inventory.⁴² MDD DX = Major Depressive Disorder Diagnosis.

Table 3

Dispositional mindfulness (FFMQ) as a predictor of hedonic capacity (SHAPS), controlling for potential confounding variables.

	Step 1	Step 2
Variable	β	β
Step 1		
BPI Pain Severity	.01	.01
BPI Pain Interference	-.29 *	-.24 *
Major Depressive Disorder DX	-.14	-.06
Step 2		
FFMQ Mindfulness	-	.30 ** -
R^2	.13	.21
F	4.61 **	6.05 ***
R^2	-	.08
F	-	9.16 **

Note.

*
p < .05.

**
p .01.

p .001.

Dependent variable: SHAPS=Snaith-Hamilton Anhedonia and Pleasure Scale.⁴¹ FFMQ = Five Facet Mindfulness Questionnaire.²⁵ BPI = Brief Pain Inventory.⁴² MDD DX = Major Depressive Disorder Diagnosis.