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Effects of brief daily mindfulness practice on affective outcomes and correlates in a high BPD trait sample

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ABSTRACT

Borderline personality disorder (BPD) is a psychological disorder characterized by dysregulation across multiple domains. While selected mindfulness-based interventions are effective in addressing symptoms of BPD, less is known regarding the effects of engaging in brief mindfulness practices on affective correlates of BPD. The present study investigated the effects of engaging in brief, daily mindfulness practice in a sample of young adults with elevated BPD symptoms. Ninety-two participants were recruited and randomly assigned to 2 weeks of daily mindfulness meditation or relaxation practice (active control), or to a no-practice control condition. Participants completed measures assessing depression, anxiety, stress, shame, difficulties with emotion regulation, trait mindfulness, and self-compassion before and after the practice period. Compared to the no-practice control condition, mindfulness practice resulted in significant improvements in trait mindfulness and self-compassion, whereas relaxation practice led to reductions in emotion regulation difficulties. No significant differences were found on any of the other outcomes between the mindfulness and relaxation conditions. The findings suggest that while both mindfulness and relaxation-based practices are effective in targeting selected transdiagnostic processes associated with BPD, more intensive interventions may be required for the practices to induce changes at the level of psychological symptoms.

1. Introduction

Borderline personality disorder (BPD) is a psychological disorder marked by a pervasive pattern of impulsivity, hostility, self-injury, and instability of self, interpersonal relationships and negative affect (American Psychiatric Association [APA], 2013). It is a disorder associated with a high risk of self-harm and suicidal behaviors (Linehan et al., 1991), as well as high levels of mental and general healthcare utilization (Skodol et al., 2005). An epidemiologic survey of American adults assessed the lifetime prevalence of BPD to be 5.9% (Grant et al., 2008).

According to the biosocial model, BPD is characterized by marked emotion dysregulation, which arises from a transactional relationship between pre-existing emotional vulnerability and an invalidating childhood environment (Linehan, 1993). Due to repeated experiences with invalidation, people with BPD often struggle with expressing, as well as regulating their emotions effectively. Therefore, BPD has been conceptualized as a disorder involving difficulties with emotion regulation, or emotion dysregulation as its core feature. Of various emotions, shame is among the most prominent emotions experienced by BPD patients, likely due to their tendency in engaging in chronic self-invalidation or self-criticism (Crowe, 2004; Rizvi et al., 2011; Rüsch et al., 2007). Further, BPD is often characterized by high levels of comorbid psychological symptoms, such as depression, anxiety, and stress (Skodol et al., 2002a,b).

Notably, even though individuals need to fulfil a select number of criteria (5 out of 9 symptoms) to be diagnosed as having BPD (APA, 2013), symptoms of BPD have been found to exist on a continuum. For example, one study involving adolescents found a broad dispersion of BPD symptoms in the sample, ranging from a total absence of these symptoms all the way to meeting full diagnostic criteria (Chabrol, Chouicha, Montovany and Callahan, 2001). Consistent with the biosocial model (Linehan, 1993), individuals with subclinical BPD symptoms (i.e., having clinically significant BPD features without necessarily fulfilling diagnostic criteria) have also been found to demonstrate elevated etiological features associated with BPD, such as parental psychopathology, childhood abuse, and impulsivity (Chapman et al., 2008; Trull. 2001).

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Among various interventions developed for treating BPD, dialectical behavior therapy (DBT) is a multimodal therapeutic approach that has received empirical support in reducing core symptoms of BPD, such as suicidal and self-harm behaviors, anger, social maladjustment, and impulsivity (Kliem et al., 2010). Of several skills taught in DBT, mindfulness is considered as a foundational skill. Mindfulness refers to the ability to focus one's attention on experiences in the present moment, and to relate to the experiences in an intentional and nonjudgmental manner (Kabat-Zinn, 2003). Theoretically, training in mindfulness facilitates the ability to decenter from one's thoughts and emotions, such that these experiences are perceived as passing mental events as opposed to representations of reality that one automatically identifies with (Shapiro et al., 2006). As a result, mindfulness training may increase the ability to tolerate distress without resorting to maladaptive ways of regulating one's emotions. Also, the nonjudgmental aspect of mindfulness training may be an effective approach for addressing shame and self-invalidation commonly experienced by individuals with BPD. In DBT, mindfulness is taught primarily as a set of behavioral skills, consisting of "what" skills (where individuals learn to observe and describe their experiences, as well as participating in activities whole-heartedly) and "how" skills (where individuals learn to relate to experiences nonjudgmentally, one-mindfully, and in an effective manner). These skills are taught through a variety of behavioral exercises, including, but not limited to, mindfulness meditation.

To date, several studies have investigated the effects of mindfulness skills training in targeting core features associated with BPD. Elices et al. (2016) conducted a randomized trial comparing the efficacy of two DBT skills training modules (mindfulness and interpersonal effectiveness; taught over 10 weeks) in a sample of patients diagnosed with BPD. The study found that compared to those assigned to the interpersonal effectiveness module, those in the mindfulness module reported significantly greater reductions in BPD symptoms and increases in decentering. In the same study, participants assigned to the mindfulness training module demonstrated improvements in two facets of impulsivity (subjective time perception and tolerance for delay rewards), although no changes were observed in trait impulsivity or response inhibition (Soler et al., 2016). Lastly, Soler et al. (2012) examined the effects of mindfulness training (taught as a DBT module) as an adjunct to general psychiatric management (GPM), and found that patients assigned to the mindfulness skills module, compared to those who received only GPM, demonstrated significant improvements in several behavioral measures of attention functioning and impulsivity.

Taken together, the above studies demonstrate the benefits of mindfulness skills training in targeting several symptomatic and attentional aspects of BPD. However, as mindfulness is taught using a range of behavioral exercises in the context of DBT, less is known regarding the effects of specific *forms* of mindfulness practices on individuals with BPD and BPD traits. Of various practices commonly taught in mindfulness-based interventions, mindfulness of breathing is among the most commonly taught and practised form of meditation. It involves directing and sustaining one's attention on the physical sensations of breathing, and nonjudgmentally bringing the attention back to the breath when one's attention has wandered (e.g., to specific thoughts, memories, or feelings). While a number of studies have investigated the effects of mindful breathing in several clinical and nonclinical populations (e.g., Arch and Craske, 2006; Broderick, 2005; Keng et al., 2013), little work has examined the effects of sustained, daily practice of mindful breathing among individuals with BPD traits.

In a study involving adults with elevated BPD traits, Keng and Tan (2017) found that those assigned to engage in a brief mindfulness of breathing induction demonstrated significantly greater reductions in shame in response to an autobiographical memory recall procedure, compared to those assigned to a loving-kindness meditation induction or no-instruction condition. In another study, a brief mindful breathing induction was found to result in significantly quicker reductions in negative affect and feelings of rejection compared to a no-instruction control condition (Keng and Tan, 2018). While these studies demonstrate the benefits of brief mindfulness meditation as an emotion regulation strategy, they are limited by the use of a brief, one-time induction, which precludes the assessment of the broader effects of mindfulness meditation in the form of repeated, daily practice. There is therefore a need for research investigating the effects of sustained daily mindfulness practice on symptoms and features associated with BPD. Given that mindfulness is known to improve emotion regulation (Teper et al., 2013) and affective outcomes including depression, anxiety, and shame (Hofmann et al., 2010; Keng and Tan, 2017), we were particularly interested in examining the effects of daily mindfulness practice on these outcomes, which are also known to be core features and/or common comorbid presentations of BPD (Crowe, 2004; Linehan, 1993; Skodol et al., 2002,b; Rizvi et al., 2011).

Further, few studies have evaluated the effects of mindfulness training in comparison with active control conditions, which precludes assessment of the unique effects of mindfulness training over and above confounding factors, such as expectancy effect. It has been suggested that the effects of mindfulness training may be attributed in part to a general relaxation effect, versus unique mechanisms theorized to be underlying the effects of mindfulness-based interventions (e.g., increased trait mindfulness and self-compassion) (Baer, 2003). In this study, we were interested in isolating the effects of mindfulness practice from those of general relaxation, by comparing the effects of mindful breathing against an active control condition consisting of passive muscle relaxation. Notably, even though mindfulness and relaxation practices are conceptualized as two different practices in this study, they share some overlapping elements. For example, passive muscle relaxation involves bringing awareness to different muscle groups and systematically releasing tension in these muscles (Bernstein and Borkovec, 1973; Everly and Rosenfield, 1981), the first aspect of which resembles the practice of body scan meditation in mindfulness-based interventions. However, both practices also differ in that mindfulness practice involves adopting an accepting, nonjudgmental orientation towards one's experiences (Kabat-Zinn, 2003), an element that is missing from relaxation practice. In fact, relaxation practice involves striving to change one's experience by releasing tension in the muscles, which is opposite to the emphasis on accepting one's experience in mindfulness practice. Cultivating a nonjudgmental attitude via mindfulness training may be particularly useful for addressing shame and self-criticism, which are common features among individuals with BPD (Crowe, 2004; Keng and Tan, 2017).

To date, several studies have investigated the effects of mindfulness training relative to relaxation practice. Jain et al. (2007) compared the effects of one month of mindfulness training against somatic relaxation training, and found that both interventions led to improvements in distress and positive mood states. However, only the mindfulness training condition showed significant decreases in distractive and ruminative thoughts and behaviors. In a study by Agee et al. (2009), both mindfulness and relaxation training were found to be equivalently effective in lowering psychological distress. Taken together, the findings suggest that while mindfulness and relaxation may be equally effective in reducing distress, mindfulness training may be unique in its ability to facilitate adaptive cognitive styles (e.g., lower rumination).

1.1. Specific aims and hypotheses

The goal of the present study was to investigate the effects of brief, daily practice of mindful breathing on a number of features associated with BPD, including difficulties with emotion regulation, shame, depression, anxiety, and stress, as well as processes purported to be the mechanisms underlying the effects of mindfulness-based interventions, namely trait mindfulness and self-compassion. The effects of mindful breathing were compared against relaxation practice and a no-practice control condition. It was hypothesized that compared to the no-practice control condition, those assigned to engage in daily mindfulness

practice would demonstrate greater reductions in difficulties with emotion regulation, shame, depression, anxiety, and stress, as well as improvements in trait mindfulness and self-compassion. Based on prior research (Jain et al., 2007; Agee et al., 2009) and theorized mechanisms of mindfulness-based interventions (Baer, 2003; Keng et al., 2012), we hypothesized that relative to relaxation practice, mindfulness practice would be equally effective in reducing depression, anxiety, stress, and emotion regulation difficulties, and more effective in reducing shame, and increasing trait mindfulness and self-compassion.

2. Methods

2.1. Participants

Participants were recruited via fliers, online advertisements, and the university's undergraduate research subject pool. Interested participants were presented with an online pre-screening survey, which included the Personality Assessment Inventory – Borderline Features (PAI-BOR; Morey, 1991). To be eligible for the study, participants had to meet the following inclusion criteria: a) age between 18 and 55 years old, b) proficient in English, and c) acquiring a score equal to or greater than 38 on the PAI-BOR. This cut-off has been employed in previous studies involving analogue BPD samples (e.g., Chapman and Dixon-Gordon, 2007; Chapman et al., 2008; Trull, 2001), and indicates clinically significant BPD features (Morey, 1991). A power analysis indicated that a sample size of 92 would be needed to achieve 80% power, assuming a medium effect size (Keng and Tan, 2018).

Ninety-two participants were recruited and randomly assigned to 2 weeks of daily mindfulness meditation (MM; $n = 31$) or relaxation practice (RP; $n = 31$), or to a no-practice control condition ($n = 30$). Students were granted course credits for their participation, whereas members of the public received SG$50 for participating in the study. The study's protocol was approved by National University of Singapore's Institutional Review Board.

2.2. Procedure

Eligible participants attended two 1.5-hour, individual experimental sessions that were held approximately two weeks apart. In the first experimental session (T1), participants provided informed consent and completed a battery of self-report questionnaires (see measures section). Subsequently, participants assigned to an intervention condition (MM or RP) were verbally introduced to the corresponding practice before they engaged in a 10-minute practice session with an audio guide. The audio guide for the MM condition consisted of instructions to practice mindfulness of breathing. Participants were instructed to sit in a comfortable posture and become aware of their bodily sensations, followed by maintaining their awareness on the physical sensations of the breath. They were reminded to re-direct their attention back to the breath nonjudgmentally, whenever they noticed their attention wandering off to other thoughts, sensations, images, or fantasies. This exercise reflects key features of mindfulness training: paying attention to one's moment-by-moment experiences intentionally, and with an attitude of nonjudgment and acceptance (Kabat-Zinn, 2003). On the other hand, the audio guide for the RP condition consisted of a passive muscle relaxation practice adapted from Bernstein and Borkovec (1973) and Everly and Rosenfield (1981). The audio instructions guided participants to focus their awareness on a single muscle group at a time and then releasing tension from it, starting from the top of the body (i.e., muscles of the face) and moving downwards towards the shoulders, arms, abdomen, and finally the legs. Participants assigned to the NP condition did not receive any audio guide instructions.

Following the practice session, participants in both the MM and RP conditions were invited to share their reflections on the practice as well as ask any questions they might have with an experimenter. They were then provided with a daily entry log to record the duration of their daily practice and an information sheet with further details about their assigned practice. Participants were instructed to engage in their assigned practice for 10–15 min daily, for the following 2 weeks. Following the training session, participants also rated, on a scale of 1–7, the extent to which they believed the practice would be helpful in coping with stress in daily life, as well as the extent to which they thought the experimenter was enthusiastic and credible. Participants assigned to the no-practice control condition did not receive further instructions following completion of the measures. In the second experimental session (T2; approximately 2 weeks after T1), all participants were re-administered the measures used in T1. At the end of the study, participants in the no-practice control condition were offered instructions and audio guides to practice either MM or RP, depending on their expressed preference. All participants were then fully debriefed on the study and compensated for their time.

2.3. Measures

2.3.1. Demographic information form

The demographic information form assessed participant's gender, age, ethnicity, level of education, current and past diagnosis of psychological disorders, as well as prior experience with mindfulness or meditation practice.

2.3.2. BPD traits

The Personality Assessment Inventory – Borderline Features (PAI-BOR; Morey, 1991) was administered as a pre-screening questionnaire to measure symptoms of BPD. It is a 24-item self-report measure consisting of four subscales. These subscales include identity problems, affective instability, self-harm behaviors, and negative relationships. All items are rated on a Likert-type scale (1 = “not at all true”; 4 = “very true”). The PAI-BOR demonstrated good construct validity, as well as high internal consistency in a large nonclinical sample (Morey, 1991). Further, it demonstrated concurrent validity in terms of predicting the diagnosis of BPD (Stein et al., 2007) in a clinical sample. In this study, the internal consistency of the scale was 0.82.

2.3.3. Depression anxiety stress scales -21 (DASS-21; Lovibond and Lovibond, 1995)

The DASS-21 was employed to assess symptoms of depression, anxiety, and stress (Lovibond and Lovibond, 1995). The scale consists of 21 items rated on a 4-point scale. The DASS-21 demonstrated good internal consistency and reliability in a nonclinical sample of adults (Henry and Crawford, 2005). The scale has been validated in Singapore, exhibiting good internal consistency and factorial validity (Oei et al., 2013). In the present study, the internal consistency of the depression and anxiety subscales was 0.88 and 0.80 respectively.

2.3.4. Difficulties in emotion regulation scale (DERS; Gratz and Roemer, 2004)

The DERS was administered as a self-report measure of difficulties in regulating emotions. It consists of 36 statements, with a total of six subscales: impulse control difficulties (impulse), non-acceptance of emotional responses (non-accept), limited access to emotion regulation strategies (strategies), difficulties engaging in goal-directedness (goals), lack of emotional awareness (awareness), and lack of emotion clarity (clarity). Participants rated each item on a 5-point scale (1 = “almost never”, 5 = “almost always”). The DERS has a high overall internal consistency of 0.93 with a reliability coefficient ranging from 0.80 to 0.89 for the subscales in an undergraduate student sample. In the current sample, the alpha coefficient was 0.89 for the overall scale and ranged from 0.78 (aware) to 0.89 (clarity) for the subscales.

2.3.5. Positive affect and negative affect scale-expanded form (PANAS-X; Watson and Clark, 1994)

The PANAS-X was used to measure the extent to which individuals

Table 1
Baseline characteristics of participants across conditions.

	All Participants (N = 87)	Condition Mindfulness (n = 28)	Relaxation (n = 30)	Control (n = 29)
M(SD)				
Age	21.99 (2.94)	22.96 (3.92)	21.87 (2.36)	21.17 (2.05)
PAI-BOR Scores	44.33 (6.20)	44.75 (7.77)	43.63 (5.88)	44.66 (4.82)
N (%)				
Female	56 (64%)	14 (50%)	19 (63%)	23 (79%)
Chinese	64 (74%)	20 (71%)	22 (73%)	22 (76%)
Single	69 (79%)	20 (71%)	25 (83%	24 (83%)
Full-Time Student	83 (95%)	24 (86%)	30 (100%)	29 (100%)
Current Psychiatric Diagnosis	3 (3.4%)	2 (7.1%)	1 (3.3%)	0
Past Psychiatric Diagnosis	5 (5.7%)	3 (10.7%)	2 (6.7%)	0
Experience with Mindfulness/ Meditation Practice	33 (37.9%)	6 (21.4%)	14 (46.7%)	13 (44.8%)

Notes. PAI-BOR = Personality Assessment Inventory – Borderline Features.

experience shame in daily life. The PANAS-X consists of ten affective adjectives (e.g., "ashamed", "anxious"), on which participants indicated the extent to which they experienced the affective state *in general* on a 5-point scale (1 = "very slightly or not at all", 5 = "extremely"). Following Peters et al. (2014), the shame subscale was derived by removing "guilt" from the guilt subscale to be consistent with current definitions of shame. In the current study, the internal consistency of the PANAS-X shame subscale (PANAS-Shame) was 0.79.

2.3.6. Five facet mindfulness questionnaire (FFMQ; Baer et al., 2006)

The FFMQ is a 39-item measure of individual differences in trait mindfulness. The questionnaire comprises five subscales: describing, observing, acting with awareness, non-judging, and non-reactivity. Each item was rated on a 5-point scale (1 = "never or very rarely true", 5 = "very often or always true"). The subscales have demonstrated adequate internal consistency (Cronbach's alphas ranging from 0.72 to 0.92) in meditating, non-meditating and community samples (Baer et al., 2008). In the current sample, the internal consistency for the overall measure was 0.84, and ranged from 0.77 to 0.91 for the subscales.

2.3.7. Self-compassion scale (SCS; Neff, 2003)

The SCS is a 26-item scale developed to measure individuals' tendency to be kind and compassionate towards themselves. The measure consists of six subscales, namely self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification. Each item was rated on a 5-point scale (1 = "almost never", 5 = "almost always"). The SCS has demonstrated high internal consistency and test-retest reliability over a three-week interval in an undergraduate sample (Neff, 2003). In the present study, the internal consistency for the overall scale was 0.87, and ranged from 0.70 to 0.79 for the subscales.

2.4. Data analytic plan

First, we compared the groups on baseline characteristics using chi square and one-way ANOVA tests. Independent-samples t tests were run to examine whether the MM and RP groups differed on perceived usefulness of the respective practice they were assigned, perceived experimenter enthusiasm and credibility, and duration of practice during the two-week period. Further, we examined whether past experience with mindfulness or meditation practice predicted change on any of the outcome variables, by regressing Time 2 scores on the outcome variable on Time 1 scores, followed by practice experience entered in the second step. If practice experience predicted change on any of the variables, it would be included as a covariate in the subsequent primary analysis corresponding to the outcome variable. To test our study hypotheses, we tested a series of general linear models conducted using PROC GLM in SAS (Version 9.4; SAS Institute, Inc.; Cary, NC). Each model predicted a time 2 outcome from (1) continuous Time 1 value for the outcome, and (2) a categorical condition variable. Following the analyses, we conducted paired-sample t tests to examine changes in each outcome variable from pre- to post-practice period in the MM and RP conditions respectively. To reduce type I error yet maintain power to detect effects of the intervention on these outcomes, we set alpha conservatively at 0.01.

3. Results

Of 92 participants who enrolled in the study, five were excluded from analyses. These participants included one who reported exaggerating her responses on the prescreening measure (PAI-BOR), one who reported manipulating her responses to match her accurate guess of the specific hypotheses of the study, two who dropped out after attending the first experimental session, and one whose dataset for the first session was lost due to technical error. As a result, data from 87 participants were included in the analyses.

3.1. Baseline characteristics and randomization check

Table 1 presents the sample characteristics of participants across conditions. The mean age of the sample was 22 years (SD = 2.94; range = 19–36). More than half of the sample were female (64%). The majority of the sample were Chinese (74%), single (79%), and full-time students (95%). The sample's mean score on the PAI-BOR was 44.33, which is approximately 1 standard deviation above the clinically significant cut-off score (Morey, 1991). A small percentage of participants had a current or history of psychiatric diagnosis, and approximately a third of the sample had previous experience with mindfulness or meditation practice.

Chi-squared tests demonstrated no significant differences between the three conditions on gender, ethnicity, presence of current or past psychological disorders, or experience with meditation or mindfulness practice, $ps > 0.05$. One-way ANOVAs also revealed no significant differences between the three conditions on any of the continuous demographic (i.e., age) or clinical variables (e.g., BPD symptoms, trait mindfulness, self-compassion, depression, anxiety, stress, shame, and difficulties with emotion regulation) at baseline, $ps > 0.05$. Additionally, there were no significant differences between the MM and RP groups on ratings of perceived usefulness of the respective practice they were assigned, perceived experimenter enthusiasm, perceived experimenter credibility, and duration of home practice, $ps > 0.05$. Further, past experience with mindfulness or meditation practice did not predict change in any of the outcome variables, $ps > 0.05$. The average duration of home practice (in minutes) for the MM and RP groups was 101.18(SD = 46.65; range = 17–150) and 99.77 (SD = 31.08; range = 45–158) respectively.

Table 2
Means and standard deviations for outcome variables at times 1 and 2 by condition.

Variable	Mindfulness				Relaxation				Control				Effect Sizes for Group Differences in Pre-Post Change		
	Pre Mean	Pre SD	Post Mean	Post SD	Pre Mean	Pre SD	Post Mean	Post SD	Pre Mean	Pre SD	Post Mean	Post SD	M v C (Glass' Δ)	R v C (Glass' Δ)	M v R (Cohen's d)
DASS Depression	14.36	7.78	12.82	9.26	15.13	7.93	11.67	6.37	16.21	8.18	16.34	9.86	−0.20	−0.44*	.24
DASS Anxiety	14.57	7.03	11.32	4.93	12.47	6.82	8.77	5.86	13.79	7.73	12.69	8.49	−0.37	−0.45*	.06
DASS Stress	20.07	8.08	15.36	9.90	19.07	7.50	13.97	5.49	19.66	7.17	18.97	8.56	−0.57†	−0.62*	.04
DERS Total	101.25	20.49	96.18	22.78	109.07	17.13	98.70	17.87	105.86	15.46	106.35	19.06	−0.58†	−1.12**	.34
PANAS Shame	12.68	4.62	10.71	4.54	12.30	4.34	10.83	3.87	13.10	4.28	12.90	4.61	−0.61*	−0.44†	−0.14
FFMQ Total	114.39	12.54	124.36	15.72	109.87	13.80	118.53	12.85	110.86	14.92	112.45	14.88	.99**	.84*	.09
SCS Total	2.74	0.47	3.04	0.49	2.58	0.45	2.86	0.47	2.55	0.44	2.61	0.53	.86**	.78*	.05

Notes. DASS = Depression, Anxiety, and Stress Scales; DERS = Difficulties with Emotion Regulation Scale; PANAS = Positive and Negative Affect Schedule; FFMQ = Five Facet Mindfulness Questionnaire; SCS = Self-Compassion Scale. Based on Glass et al. (1981)'s recommendations, Glass' Δ was used in place of Cohen's d as the effect size for comparisons involving the control condition. †$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 3
Test Statistics from Within-Group Analyses Comparing Outcome Variables at Times 1 and 2.

Variable	Mindfulness		Relaxation		Control	
	t	Cohen's d	*t*	Cohen's d	*t*	Cohen's d
DASS Depression	.83	.16	3.00	.55**	−0.090	.01
DASS Anxiety	2.44	.46*	2.85	.52**	1.02	.19
DASS Stress	2.69	.51*	3.37	.62**	.52	.09
DERS Total	1.42	.27	4.90	.89***	−0.27	.05
PANAS Shame	2.88	.54**	2.63	.48*	.39	.07
FFMQ Total	−3.37	.64**	−3.64	.66**	−1.00	.19
SCS Total	−3.20	.61**	−4.30	.78***	−1.25	.23

Notes. DASS = Depression, Anxiety, and Stress Scales; DERS = Difficulties with Emotion Regulation Scale; PANAS = Positive and Negative Affect Schedule; FFMQ = Five Facet Mindfulness Questionnaire; SCS = Self-Compassion Scale.*$p < .05$,**$p < .01$, ***$p < .001$.

3.2. Primary analyses

Time 1 and Time 2 means and standard deviations for each variable by time and condition, as well as p values for condition contrasts, are presented in Table 2. Based on an alpha of 0.01, no significant condition contrasts emerged for change over time in depression, anxiety, stress, or shame. Perhaps most notably, no significant contrasts emerged between MM and RP, indicating that they did not differ in their impact on changes for any outcome.

Pairwise contrasts *comparing the MM and no-practice control conditions* revealed that MM participants demonstrate greater increases in trait mindfulness and self-compassion compared to participants in the no-practice condition. Examination of the FFMQ subscales revealed that this effect on the FFMQ total score was driven by a significant benefit of MM over the no-practice control condition on the acting with awareness facet of the FFMQ, $p < .001$. Contrasts *comparing the RP and no-practice control conditions* show that, relative to the no-practice condition, RP was associated with a greater reduction in difficulties with emotion regulation. Effect sizes for these comparisons were large.

Table 3 present results from within-group analyses examining changes in each outcome variable from Time 1 and Time 2. Within the MM condition, there were significant increases in trait mindfulness and self-compassion, and decreases in shame. Within the RP condition, there were significant increases trait mindfulness and self-compassion, and decreases in depression, anxiety, stress, and difficulties with emotion regulation. Effect sizes were mostly in the moderate range. No significant changes were observed on any outcome variable in the no-practice control condition.

4. Discussion

The present study examined the effects of 2 weeks of daily mindfulness and relaxation practice on a range of psychological symptoms and affective outcomes in a sample of young adults with elevated BPD traits. Compared to the no-practice control condition, mindfulness practice resulted in significant improvements in trait mindfulness and self-compassion, whereas relaxation practice led to reductions in difficulties with emotion regulation. Both practices did not differ on their effects on any outcome variable. Within the relaxation condition, there were improvements in the majority of outcomes pre- to post-practice; in the mindfulness condition, beneficial improvements were observed for trait mindfulness, self-compassion, and shame, but not the other outcomes.

Whereas the majority of studies have examined the effects of either group-based mindfulness courses or one-time, brief mindfulness inductions on psychological outcomes, the present study examined and demonstrated the effects of engaging in sustained, self-guided brief mindfulness practice on a range of BPD-relevant correlates and outcomes. The finding that the practice was associated with improvements

in trait mindfulness and self-compassion is consistent with theorized mechanisms underlying the effects of mindfulness training (Keng et al., 2012). In particular, the effects on trait mindfulness were largely driven by beneficial changes in *acting with awareness*, a facet of mindfulness that has been associated with greater psychological well-being and lower psychological symptoms (Baer et al., 2008). It remains to be investigated whether more intensive or sustained mindfulness practice will lead to changes in other facets of mindfulness that capture more attitudinal dimensions of the practice (e.g., nonjudging and nonreactivity). Meanwhile, relaxation practice led to significant reductions in emotion regulation difficulties, which may be due to the practice's effect in lowering psychophysiological arousal and increasing awareness of one's psychosomatic states. The finding also corresponds to the almost century-old idea that relaxation of the body is indispensable in the control of emotion (Jacobson, 1929). Taken together, the findings illustrate the effects of daily mindfulness practice in improving selected transdiagnostic processes, particularly self-compassion (Barlow et al., 2017; Keng and Wong, 2017; MacBeth and Gumley, 2012; Westphal et al., 2016) and trait mindfulness (Greeson et al., 2014; Gu et al., 2015), which may serve as protective factors of psychopathology. For example, changes in trait mindfulness have been found to mediate the effects of mindfulness-based interventions on a range of psychological outcomes (Gu et al., 2015), whereas self-compassion has been found to buffer the relationship between parental indifference and several psychopathological outcomes (Westphal et al., 2016).

Notably, the study found no difference in the effects of mindfulness versus relaxation practice on any of the outcome variables. This finding is consistent with findings of two studies that failed to find a difference in the effects of mindfulness training versus relaxation in reducing psychological symptoms and distress (Agee et al., 2009; Jain et al., 2007). Arguably, mindfulness practice differs from relaxation training in its focus on systematic training in the ability to sustain and switch attention voluntarily, as well as emphasis on relating to one's experience nonjudgmentally (Bishop et al., 2004). Therefore, the differential effects of mindfulness versus relaxation may emerge more in domains pertaining to cognitive functioning, such as attentional performance (Semple, 2010).

Contrary to our expectations, mindfulness practice did not result in improvements in any of the psychological symptoms relative to the no-practice control condition. The lack of effect may be due to the fact that the study's sample consists of a subclinical population with elevated BPD symptoms, who may benefit from a more intensive mindfulness intervention. Nevertheless, results from within-group analyses demonstrate beneficial changes across all outcome variables in each experimental condition, suggesting that the practices are not entirely without benefit to the participants. Overall, results from within-group analyses largely favor the relaxation practice condition, indicating that compared to mindfulness, relaxation practice is associated with more benefits, in terms of reductions in depression, anxiety, and emotion regulation difficulties. Meanwhile, the mindfulness practice condition showed significant reductions in shame, likely due to the training's emphasis on developing a nonjudgmental way of relating to one's experiences. As mindfulness practice is traditionally understood as a practice that deepens over time through gradual and persistent practice (Kabat-Zinn, 2003), effective engagement in the practice likely requires close instructions and guidance from experienced instructors or clinicians, especially for individuals with elevated symptoms of psychopathology.

The present study can be noted for several strengths. First, the study employed a randomized controlled experimental design, with inclusion of an active control group (relaxation practice), which enables us to examine the unique effects of brief mindfulness practice over and above general effects due to relaxation training. Further, the study examined the effects of self-guided mindfulness practice in a previously underresearched population – individuals with elevated BPD traits. The study demonstrated that the majority of participants were able to engage in the practice to varying extent (range of practice duration: 17–150 min), with no adverse effects reported in the post-practice assessment and debriefing session. Meanwhile, as the study recruited a sample of adults with elevated BPD traits, the findings may not be generalizable to patients with a full diagnosis of BPD. Further, the fact that data were obtained using self-report measures means that the results may be attributable to social desirability bias and shared method variance. Future research should incorporate multiple modes of assessment (e.g., clinical interviews and physiological measures) to assess the effects of mindfulness practice on BPD correlates and symptoms. For example, it would be interesting to examine whether mindfulness training lowers sympathetic nervous system activity (e.g., using the Cardiac Sympathetic Index) in response to stressors among patients with BPD (Weinberg et al., 2009). Lastly, the study did not include follow-up assessments to examine the extent to which the effects of mindfulness practice are durable. Also, notably, two weeks is a rather short time window to evaluate change in clinical symptoms, though past research has demonstrated positive effects of mindfulness practice on depressive symptoms with a training program as short as three days (e.g., Zeidan et al., 2010). Future studies should assess the effects of mindfulness practice over a longer term to examine maintenance or change of practice effects over time.

In conclusion, the study found that brief, self-guided daily practices of mindful breathing and relaxation led to improvements in selected transdiagnostic processes related to BPD symptomatology. Both practices did not differ on their effects on any of the outcome variables, though results from within-group analyses point to an advantage for relaxation practice over mindfulness practice. It remains to be investigated whether more intensive and structured modes of training and practices would result in stronger effects. For example, a longer time window of sustained mindfulness practice (e.g., one month or more), coupled with frequent instructions and feedback from a trained therapist may lead to greater clinical benefits. Future research should also examine other domains, such as attention functioning, which may be differentially impacted by mindfulness versus relaxation training. Lastly, as mindfulness is typically taught as a set of behavioral skills in the context of DBT (Linehan, 1993), future research could examine and compare the effects of different forms of mindfulness practices (e.g., wise mind practice versus recognizing and re-stating judgments) on symptoms and correlates of BPD.

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Supplementary materials

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