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Cardiovascular responses to a laboratory stressor in women: Assessing the role of body awareness

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Abstract

Body awareness (BA) is characterised by a general tendency towards awareness and recognition of normal, non-emotive bodily processes and physical sensations. BA considers one's sensitivity towards and belief in how well they can sense, predict, and describe their bodily functions and sensations. This study investigated the role of BA in haemodynamic and anxiety responses to a laboratory stressor. Women ($n = 40$) completed assessments of BA and state/trait anxiety. Women with low BA displayed higher blood pressure (BP) and heart rate (HR) reactivity in response to the stressor than women with high BA. Delayed HR recovery poststressor was observed in women with low BA. BA was a significant predictor of haemodynamic reactivity over and above trait anxiety. BA effects on state anxiety were not observed. Thus, greater BA is associated with less haemodynamic stress reactivity in women lending further support for the development of BA interventions aimed at stress reduction.

Keywords

body awareness; cardiovascular reactivity; anxiety; mindfulness; Paced Auditory Serial Addition Task (PASAT); women

My friends, said the Buddha, there is a most wonderful way for living beings to realize purification, overcome directly grief and sorrow, end pain and anxiety, travel the true path and realize enlightenment or awaking, and this way is the establishment of the foundations of mindfulness. [The first of these four foundations is mindfulness of the body.] A practitioner remains established in the awareness of the body, in the body, diligent with clear understanding, mindful, abandoning all grasping and resistance, knowing the body for what it is. (Kornfield, 2001)

Introduction

Body awareness is characterised by a general tendency towards awareness and recognition of normal bodily processes and physical sensations. Furthermore, body awareness considers

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one's sensitivity to these sensations, and one's belief in how well they sense, predict, and describe their bodily functions (Shields, Mallory, & Simon, 1989). This characterisation of body awareness stands in stark contrast to somatically oriented constructs describing body awareness under pathological conditions. While there is a dearth of research investigating body awareness, there is a rich body of literature that explores sensitivities to emotion-related bodily sensations that characterise pathology. Moreover, there are a vast array of symptom checklists and health-related quality of life measures specific to almost any illness (for review see Preedy & Watson, 2010).

Body awareness also differs from interoceptive awareness, which focuses on the ability to perceive changes in bodily-visceral afferent information (Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004). In laboratory studies with human participants, measuring a person's ability to accurately perceive heart rate can assess interoceptive awareness. Believed to play an important role in emotion, interoceptive awareness has been studied in many clinical contexts (Wiens, Mezzacappa, & Katkin, 2000). For example, studies show increased heart rate perception (i.e., interoceptive awareness) in those with anxiety disorders (Zoellner & Craske, 1999) and less accurate heart rate perception in those with moderate depression (Dunn, Dalgleish, Ogilvie, & Lawrence, 2007). These results highlight the connection between soma and psyche, which can be altered by mental illness.

Thus, a wide range of psychotherapeutic perspectives emphasise the clinical utility of promoting a balanced integration between psyche and soma. In fact, much clinical research over the last decade has sought to empirically validate the so-called 'third wave' of behavioural therapies, which draw upon mindfulness and acceptance to achieve this balanced integration (Öst, 2008). Understanding the particular role that mindfulness plays in psychotherapy has led to a prominent vein of study in the clinical sciences (Weiss, 2009). One of these distinct fields investigates body-oriented psychotherapy. The tenets of body-oriented psychotherapy include a focus on mindfulness of the body or body awareness. According to Price: 'body psychotherapy is psychotherapy focused on the interactions between the patient's mental representations and their bodily phenomena' (2005, p. 2). A goal of body psychotherapy is to integrate sensory and emotional awareness with body awareness, which increases the capacity for healthy body connections and associations within oneself (Young, 2006).

One clinical context in which body psychotherapy demonstrates therapeutic success is in the recovery from childhood sexual abuse (Price, 2002, 2005). Following a body-oriented intervention for women with a history of childhood sexual abuse, Price (2005) found statistically significant improvements in self-reported psychological and physiological well-being. Additionally, Price found improvements in body connection as measured by the Scale of Body Connection and Scale of Body Investment. Such promising clinical findings spark research interests in understanding underlying mechanisms of therapeutic action. In fact, given the novelty of body psychotherapy, practitioners of the therapy suggest there is an urgent need to evaluate the roles of body awareness in psychological and physiological processes that may be affected by body-oriented interventions (Rohricht, 2009).

Assessing haemodynamic responses to laboratory stressors is one way to explore physiological processes associated with various psychological states and traits. Therefore, to investigate the role that body awareness plays in haemodynamic responses to a laboratory stressor, the following study was performed. While we were unable to find any published studies detailing gender differences in body awareness, gender's contribution to differences in interoceptive awareness has been previously noted (Cameron, 2001; Cameron & Minoshima, 2002). Gender also contributes to differences in cardiovascular responses to laboratory stressors (Kajantie & Phillips, 2006; Sato & Miyake, 2004). To control for gender in the present study, only women were investigated. Participants' menstrual cycle phase was controlled for in order to avoid testing during the luteal phase, which is associated with greater cardiovascular reactivity to laboratory stressors than other menstrual cycle phases (Lustyk, Olson, Gerrish, Holder, & Widman, 2010). We also assessed self-reported trait anxiety. Although we were unable to find any published research detailing interrelationships among body awareness and trait anxiety, interoceptive awareness and trait anxiety are positively related and higher scores on either variable are associated with higher reactivity to isometric challenges (Pollatos, Herbert, Kaufmann, Auer, & Schandry, 2007). Therefore, we included a measure of trait anxiety to explore its potential role as a covariate in primary outcome analyses. Given the lack of empirical research investigating the relationships among the non-clinical assessment of body awareness and haemodynamic responses to laboratory stressors, we tested a non-directional hypothesis. Specifically, we hypothesised that body awareness would be associated with haemodynamic responses to a laboratory stressor in women.

Methods

Power analyses

Power analyses were performed with G-Power 3.0.3 (Faul, Erdfelder, Lang, & Buchner, 2007). Given the lack of prior research investigating body awareness effects on psychophysiological responses to laboratory stress in women, we set our effect size input parameters as small-moderate with f^2 0.16, $\alpha = 0.05$, and $1 - \beta = 0.80$. For a mixed model RM-ANOVA with two groups and five measures (see *Data reduction and analyses*), the needed sample size calculation was 40. Using input parameters $d = 0.5$, $\alpha = 0.05$, and $1 - \beta = 0.80$ for a two-tailed paired t -test to assess psychophysiological reactivity the calculated sample size was 34. Finally, to perform two-tailed bivariate correlations with input parameters $p = 0.5$, $\alpha = 0.05$, and $1 - \beta = 0.80$ the calculated sample size was 26.

Participants

Following approval from the University Institutional Review Board, participants were recruited via local advertisements. Our advertisements instructed interested participants to call our laboratory for screening, which involved assessing inclusion/exclusion criteria. Eligible women ($N = 42$) self-identified as: (a) 18–45 years of age (not premenarcheal or menopausal); (b) nonsmokers; (c) not pregnant, nursing, or amenorrheic and having a cycle length of 21–40 days; (d) not taking medications known to affect the stress response (e.g., psychotropics); (e) free from chronic physical and mental health conditions (e.g., hypertension, known arrhythmias, obesity, major depression); (f) able to read and write

English; and (g) able to come to our lab for a one-hour stress testing session during their follicular cycle phase (days 5–9) to control for the influence of luteal phase hormones on cardiovascular reactivity (Lustyk et al., 2010).

Apparatus and measures

Haemodynamic measures—Blood pressure (BP) was assessed at timed intervals and measured with an automatically inflated sphygmomanometer (Dinamap 1846; Critikon Inc., Tampa, FL). Heart rate (HR) was continuously measured with electrocardiography via the online chart recorder system Powerlab (Powerlab 800; ADInstruments, Boulder, CO).

Body awareness—The 18-item Body Awareness Questionnaire (BAQ; Shields et al., 1989) assessed reported attentiveness to normal non-emotive body processes, sensitivity to body cycles/rhythms, ability to detect small changes in normal functioning, and to anticipate bodily reactions. In completing the BAQ, women indicated their congruence with statements such as ‘I am aware of a cycle in my activity level throughout the day’, and ‘I notice specific bodily reactions to being over hungry’. Shields et al. reported good test-retest reliability ($r = 0.80$) and internal consistency ($\alpha = 0.83$) with the BAQ. The alpha coefficient in the present study was 0.81.

State-trait anxiety—Self-reported state (STAI-S) and trait (STAI-T) anxiety were assessed via the corresponding portions of the Spielberger State/Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI-S was completed before and immediately after the stressor task (detailed below in *Procedure*). In completing the STAI-S, women rated their present moment feelings of tension, nervousness, and the like, whereas completing the STAI-T required rating the same feelings but in the context of what is typical for the woman. Spielberger et al. reported acceptable internal reliability for the state measure ($\alpha = 0.86$ – 0.95) and test-retest reliability coefficients for time intervals of one hour to 104 days that were moderate ($r = 0.16$ – 0.62) for transitory emotional states and high ($r = 0.65$ – 0.86) for trait anxiety. Assessing state anxiety as a representative measure of the psychological aspects of stress reactivity in response to laboratory or naturalistic stressors is common practice in research of this type (see Lustyk et al., 2010).

Demographic and health information—Participants provided information on their age, ethnicity, education, perceived cycle normality and length, history of chronic illness, and regular medication use including hormonal contraception.

Index of Clinical Stress (ICS)—To control for stress from traumatic life events or other extreme stressors in the six-months preceding study participation, women completed the ICS. The ICS is a 25-item instrument designed to measure the degree or magnitude of problems individuals have with personal stress (Abell, 1991). Using a seven-point Likert scale ranging from 1 = none of the time to 7 = all of the time, participants rate items such as ‘I feel that I am losing control of my life’ and ‘I feel like I am stretched to the breaking point’. Scores range from 0 to 100. Abell reported excellent internal consistency ($\alpha = 0.96$). Cronbach’s alpha in the present study was 0.94.

Procedure

Following telephone screening to assess eligibility, laboratory stress testing sessions (i.e., testing) were scheduled between 1:00 PM and 3:00 PM to control for the diurnal rhythm in cortisol levels. Although we did not measure glucocorticoid levels, cortisol is known to amplify stress responses once they have occurred, thus it is advisable to avoid stress testing during large changes in the diurnal cortisol slope (McEwen & Stellar, 1993). Prior to testing, participants were reminded to avoid: (a) alcohol/tobacco within 24-hours of testing (note: sample self-identified at screening as non-smokers and non-substance abusers), (b) eating or drinking (except water) within one hour of testing, (c) heavy exercise the morning of testing, and (d) over the counter medications such as aspirin, acetaminophen (e.g., Tylenol), ibuprofen (e.g., Advil, Motrin), or cold/allergy medicines on the morning of testing. Upon arrival to the laboratory, participants were queried whether they complied with these restrictions. Violations of these restrictions led to rescheduling testing for the participant's next menstrual cycle.

The timing of testing was based on menstrual cycle phase. Counting menses onset as day 1, testing occurred during days 5–9 post-menses onset, which corresponds to the mid-follicular phase and a relatively steady and moderate level of ovarian estradiol. The selection of this testing time frame is consistent with previous research investigating the stress response across the menstrual cycle (see Lustyk et al., 2010).

Figure 1 depicts the timeline for data collection during testing. Prior to acquiring physiological data (i.e., testing), participants sat comfortably and completed the demographic questionnaire, STAI-T, BAQ, and ICS. Next, ECG electrodes were placed and the blood pressure cuff was secured. The researcher then provided a brief overview of the testing protocol and provided ample time for participants to ask questions. Following this, data acquisition began. Testing consisted of three periods: (1) baseline, (2) stressor, and (3) recovery.

Baseline—Testing began with a 15-minute baseline period while BP was taken at five-minute intervals. Participants completed the STAI-S at 10-minutes. HR was continuously monitored throughout testing via Powerlab supported ECG.

Stressor—At the end of baseline, the stressor period began. The stressor period lasted 8 minutes with BP taken at two-minute intervals. The stressor employed was the cognitive Paced Auditory Serial Addition Task (PASAT; Gronwall, 1977). The PASAT involved four trials of 50 single digits presented via audiocassette with increasing pace. The digit presentation rate increased over the four trials with verified rates of 2.4, 2.0, 1.6, and 1.2 seconds per digit, respectively. Following standardised protocol instructions and practice trials to ensure that participants understood the task, participants audibly added each newly presented digit to the one immediately preceding it while answers were recorded. Immediately following the PASAT, a second STAI-S was completed. Each participant finished the entire eight-minute tape regardless of performance.

Recovery—Following the stressor period, participants remained reclined for a 15-minute recovery period. During recovery, HR was continuously monitored and BP was taken at two-

minute intervals (as was done during the stressor phase) for the first 10 minutes of recovery. A final recovery BP was taken at 15 minutes coinciding with the end of testing. Following recovery, participants were debriefed.

Statistical procedures

Missing data—In light of recent arguments on the value of imputing missing data prior to statistical analyses (Buhi, Goodson, & Neilands, 2008), we assessed degree of missingness to determine if imputation was warranted. Missing values were attributed to the two women who dropped after screening prior to performing the laboratory session. Since no data beyond screening was acquired from these women, we reduced the overall sample size by two and no data were imputed.

Data reduction and analyses—Data reduction was applied to HR and BP assessments for reactivity and recovery analyses. Single means were generated for baseline and stressor time periods and recovery was reduced to three five-minute blocks. This data reduction resulted in means for five time points which were: (a) baseline, (b) stressor, (c) first five-minutes (Recovery 1), (d) second five-minutes (Recovery 2), and (e) third five-minutes of recovery (Recovery 3). No reductions were applied to state anxiety data.

Prior to hypothesis testing, data were assessed for normality and homogeneity of variance (HOV) with univariate box plots, bivariate scatterplots, and with Kolmogorov-Smirnov and Levene tests. As this study employed a repeated measures design, compliance with test assumptions was assessed for each variable at each time point for comparison. None of the variables studied revealed violations to normality, HOV, or sphericity assumptions at any time points used in analyses.

The haemodynamic outcome measures were HR, systolic blood pressure (SBP), and diastolic blood pressure (DBP). Mean state anxiety was calculated at baseline and immediately post-stressor. Mean trait anxiety and body awareness were also calculated. The effects of body awareness on the haemodynamic outcomes and state anxiety were tested with mixed model RM-ANOVA. A median split was applied to the continuous body awareness values and this dichotomised variable (BAQ group) was used as the between subject factor in each ANOVA with time over the test session as the within subject factor. Time across testing (henceforth referred to as *time*) had five levels: (a) Baseline, (b) Stressor, (c) Recovery 1, (d) Recovery 2, and (e) Recovery 3. Effect sizes for significant contrasts on focused effects were calculated using the formula: $r = \sqrt{F(1, df_R) / (F(1, df_R) + df_R)}$; where df_R is the residual degrees of freedom for the model.

To determine if trait anxiety or Index Of Clinical Stress values needed to be treated as covariates in RM-ANOVA, mean differences in each of these variables for those with high and low body awareness (i.e., the dichotomised variable; BAQ group) were assessed with a *t*-test. Similarly, we assessed BAQ group differences in the frequencies of women reporting current hormonal contraception use. Partial correlation analyses between body awareness, trait anxiety, and reactivity scores were also carried out.

Results

Two women lost interest in the study and discontinued participation before participating in testing. All of the women included in the analyses complied with the pre-test restrictions and were tested at their originally scheduled testing date. The resultant sample ($N = 40$) was 70% Caucasian, 10% Asian American/Pacific Islander, 8% Hispanic/Mexican American, 5% Black, 3% Native American/Alaskan Native, and two women chose not to indicate their ethnicity. On average, women were 28 years old (range 18–44 years) with five years of education past high school (range 0–9 years). The entire sample self-reported having regular menstrual cycles between 21–35 days in length and seven women indicated using hormonal contraception at the time of testing. The frequency of women using hormonal contraception did not significantly differ between BAQ groups. Moreover, hormone use was not correlated with any of the dependent variables assessed in this study. Therefore hormone use was not considered a covariate in analyses. Additional covariate assessments were non-significant. Specifically, t -tests revealed non-significant differences in trait anxiety and clinical stress between women in the high and low BAQ groups. Therefore, the following analyses were run without covariates considered.

Haemodynamic responses and body awareness

Heart rate and blood pressure responses in women with high or low body awareness are depicted in Figure 2. Statistically significant main effects of time were observed in HR $F(4, 152) = 60.50, p < 0.001$, SBP $F(4, 152) = 54.23, p < 0.001$, and DBP $F(4, 152) = 79.04, p < 0.001$.

Significant interactions with body awareness existed in all three haemodynamic outcome measures. For HR, the two-way body awareness by time interaction was statistically significant, $F(4, 152) = 11.66, p < 0.001$. Contrasts revealed that the first $F(1, 38) = 25.345, p < 0.001$ $r_{\text{baseline to stress, high vs. low body awareness}}$ and second $F(1, 38) = 6.74, p = 0.01$ $r_{\text{baseline to recovery 1, high vs. low body awareness}}$ interaction terms were significant. Thus, HR reactivity was greater in women that self-reported low body awareness than in women who reported high body awareness and women with low body awareness were slower to recover to baseline HR than women with high body awareness.

For blood pressure, the two-way body awareness by time interactions were statistically significant, SBP $F(4, 152) = 54.231, p < 0.001$; DBP $F(4, 152) = 79.035, p < 0.001$. Contrasts revealed that only the first interaction terms were significant $F(1, 38) = 94.81, p < 0.001$ $r_{\text{baseline to stress, high vs. low body awareness}}$ and $F(1, 38) = 5.48, p < 0.001$ $r_{\text{baseline to stress, high vs. low body awareness}}$.

State anxiety responses and body awareness

Statistically significant main effects of time were observed in STAI-S $F(1, 38) = 83.53, p < 0.001$; however, the two-way body awareness by time interaction was non-significant, $F(1, 38) = 0.886, ns$.

Partial correlations and regression analyses

Partial correlations among the continuous body awareness measure, trait anxiety, and haemodynamic reactivity values are reported in Table 1. Of the two predictors, body awareness independently predicted more haemodynamic changes than trait anxiety. Only SBP was related to trait anxiety when body awareness was controlled for. As a final investigation aimed at assessing the combined contribution of body awareness and trait anxiety on SBP reactivity, a series of multiple regression analyses with post-hoc probing for interactions were performed in accordance with the methods of Aiken and West (1991). Although the interaction was non-significant, an interesting pattern emerged suggesting that the relationship between trait anxiety and SBP reactivity was moderated by body awareness, albeit non-significantly (Figure 3).

Discussion

The purpose of the present study was to investigate haemodynamic responses to a laboratory stressor in women with varying levels of body awareness. We found that women with low body awareness demonstrated significantly more reactivity in HR and BP than women with high body awareness. Moreover, women with low body awareness were slower to recover to baseline HR following the stressor task than women with high body awareness. However, state anxiety reactivity did not differ by level of body awareness.

The haemodynamic responses reported here are noteworthy given the predictability of illness from exaggerated cardiovascular reactivity and delayed cardiovascular recovery. For example, the reactivity hypothesis posits that excessive haemodynamic reactivity to standardised laboratory stressors is predictive of cardiovascular disease risk (Krantz & Manuck, 1984). Furthermore, impaired cardiovascular recovery following standardised laboratory stressors may serve as a marker for prolonged haemostatic responses that directly influence cardiovascular disease pathogenesis (Steptoe & Marmot, 2006). Thus, it seems reasonable to postulate that traits such as body awareness, which in the present study was associated with attenuated hemodynamic reactivity to the stressor and more rapid heart rate recovery to baseline poststressor, may be associated with more favourable health predictions. Future research is needed to elucidate such predictions.

Additionally, the results from the current study carry potential clinical significance in that they align with the goals of body-oriented and mindfulness-based psychotherapies. One objective of body-oriented therapy is to teach body-focused attention with a goal of improving inner body awareness. Price (2005) found that women with a history of childhood sexual abuse treated with body-oriented therapy demonstrated increased body awareness, reduced stress, and improved psychological and physical well-being over the course of the intervention and into a three-month follow-up. While the small sample size prevented adequate power to explore complex interaction models of treatment outcomes in the Price study, it seems reasonable to expect that improved outcomes with increased body awareness may be mediated by stress reduction. The results from the present study support such an expectation as we demonstrated that higher levels of body awareness, which are entrained with body psychotherapy, resulted in less haemodynamic reactivity than low levels of body awareness. Thus, intuitively, increasing body awareness may ultimately facilitate reductions

in stress reactivity. Based on the findings reported here, additional research exploring the complex interactions between body awareness, stress, and health measures is warranted.

Our findings may also have therapeutic implications when considered within the broader context of mindfulness meditation's purported role in the promotion of mental health. Marlatt and Kristeller (1998) describe mindfulness meditation as completely attending to experiences on a moment-to-moment basis, non-judgmentally, and in a non-reactive fashion. The therapeutic efficacy of mindfulness-based interventions has been investigated in the treatment of a variety of clinical presentations. For instance, Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) has been effective in treating patients with chronic pain and anxiety disorders; Mindfulness Based Cognitive Therapy (MBCT; Segal, Teasdale, & Williams, 2002) has been shown to prevent depression relapse; and Mindfulness Based Relapse Prevention (MBRP; Bowen, Chawla, Collins, Witkiewitz, Hsu, Grow, et al., 2009; Bowen, Chawla, & Marlatt, 2010) has recently been shown to reduce cravings in individuals with substance use disorders.

One objective of mindfulness-based therapy is to teach present moment, non-judgmental attention strategies with a goal of recognising the separation between the observer and that which is being observed (Carmody, 2009). That is, the practitioner is increasingly able to objectively (i.e. nonjudgmentally) experience physical, mental, and emotional states as separate observable elements of their own identity. According to Farb et al. (2010), a shift in attention away from subjective appraisals of affect to a more sensory-based experience of emotion may reduce chronic reactivity. These researchers found neurobiological support for this shift in self-reflection among mindfulness practitioners. In the study, practitioners engaged in an experiential task involving self-focus on thoughts, feelings, and body awareness, without purpose or goal other than noticing them from moment to moment. Using functional magnetic resonance imaging (fMRI), results revealed distinct brain activation in regions associated with detached, objective, interoceptive and somatic awareness (Farb, Segal, Mayberg, Bean, McKeon, Fatima, et al., 2007). According to our findings reported here, women with greater body awareness were less reactive to the stressor. Thus, it may be that some aspect of body awareness as measured in the present study aligns with the body awareness component of mindfulness training, as both are associated with more favourable stress responses.

At first pass, the findings reported here may seem to contradict the positive relationships reported in studies investigating interoception and anxiety (e.g., Critchley et al., 2004; Pollatos et al., 2007). For example, Pollatos and colleagues found that higher levels of interoceptive awareness were related to higher levels of haemodynamic reactivity to physical stress. Conversely, in the present study we found that higher levels of body awareness were associated with less haemodynamic reactivity to the stressor. Moreover, in the present study, we found that body awareness was a better predictor of haemodynamic reactivity than trait anxiety. Only SBP was related to trait anxiety after controlling for body awareness, yet the positive relationship aligns with the findings of Pollatos and colleagues. It may be that a complex interaction between body awareness, interoceptive awareness, and trait anxiety exists such that a balance between body awareness and interoceptive awareness is needed to attenuate haemodynamic responses in highly anxious individuals. Or perhaps, as with trait

mindfulness and stressor responding (Arch & Craske, 2010), body awareness may relate to stress responses in women above and beyond contributions from affect such as anxiety. Additional research is needed to investigate these potential interactions.

Limitations of the current study include the use of only one measure of body awareness. At the time of this study there were few assessments of body awareness that did not focus on pathology. Sub-scales from newer measures of trait mindfulness that assess components of body awareness may be worthy of investigation in future studies (e.g., the Five Facets Mindfulness Questionnaire; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). Another limitation lies with gender; only women were studied. While one strength of our design was that we controlled for menstrual cycle phase at the time of stress testing, a comparison group of men would have allowed us to extend our findings. Finally, as ours was a preliminary investigation into the role that body awareness plays in healthy women's stress responses, we screened for mental and physical illnesses. While it is intuitive that an attenuated reactivity response would be associated with favourable health outcomes, it is also possible that blunted reactivity is indicative of pathology in women. Some experts in the field of psychophysiology suggest that blunted reactivity or delayed recovery are indicative of poor allostatic load or a maladaptive response to stress (McEwen, 2007). This allostatic hypothesis has gained support in various clinical contexts. For example, low resting heart rate and deficient heart rate reactivity are consistent markers of severe conduct problems in children (Beauchaine, 2001; Brenner, Beauchaine, & Sylvers, 2005). Further, heightened basal cardiovascular functioning, reactivity, and delayed recovery have been found in laboratory and ecological studies investigating the psychophysiology of posttraumatic stress disorder (Bedi & Arora, 2007; Buckley, Holohan, Greif, Bedard, & Suvak, 2004; Buckley & Kloupek, 2001). In the present study, trait anxiety was the only measure of potential psychopathology employed and it failed to predict haemodynamic responses other than SBP. Still, the relationship was positive but buffered by body awareness, albeit nonsignificantly. As such, our findings do not support the allostatic hypothesis as described here, yet additional research is needed to tease out the specific relationships among psychopathology, body awareness, and haemodynamic responses to laboratory stressors in women.

In conclusion, this study provides initial evidence that body awareness is associated with favourable haemodynamic responses to a laboratory stressor in women. These findings are noteworthy given that practicing body awareness is foundational to cultivating mindfulness. As Kornfield (1993) suggested, '[w]ith awareness, we can cultivate a willingness to be open to physical experiences without struggling against them – to actually live in our bodies' (p. 43). In light of the findings presented here, developing interventions specifically aimed at increasing body awareness in order to reduce stress reactivity in women is warranted. Moreover, further investigation of the role of body awareness in reducing stress reactivity in clinical samples may provide additional insights into the mechanisms underlying the effectiveness of a variety of current mindfulness and body-oriented treatment modalities.

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Figure 1.

Protocol timeline for data collection during laboratory testing.

Note: The 0 minute interval signifies the start of a new period within the laboratory session; Blood pressure was taken at each time interval above, with the exception of the 0 minute demarcations and 12 min recovery; Heart rate was monitored continuously throughout the laboratory session; STAI-S = State Trait Anxiety Inventory – State portion; Assessments = Demographic Questionnaire, STAI-T (State Trait Anxiety Inventory – Trait portion), Body Awareness Questionnaire, Index of Clinical Stress.

Figure 2.

Heart rate and blood pressure responses in women with high or low body awareness. (a)

Heart Rate; (b) Systolic Blood Pressure and (c) Diastolic Blood Pressure.

Note: Heart rate unit of measure is beats per minute (BPM). Blood pressure unit of measure is millimetres of Mercury (mmHg). Points represent means and vertical lines depict standard errors.

Figure 3.

Regression of systolic blood pressure reactivity on mean centered trait anxiety at values of body awareness.

Note: SBP = systolic blood pressure.

Table 1

Mean changes in haemodynamic outcome variables from baseline to stressor period in women with high ($n = 20$) and low body awareness ($n = 20$).

	Low body awareness	High body awareness
Heart rate (beats per minute)	16.82	7.60
Systolic blood pressure (mmHg)	17.38	10.63
Diastolic blood pressure (mmHg)	13.43	9.57

Table 2

Partial correlation analyses between mean changes in haemodynamic variables and body awareness controlling for trait anxiety and trait anxiety controlling for body awareness.

	Partial correlation controlling for body awareness	Partial correlation controlling for trait anxiety
Heart rate (beats per minute)	−0.16	−0.53 [*]
Systolic blood pressure (mmHg)	0.33 [*]	−0.36 [*]
Diastolic blood pressure (mmHg)	0.27	−0.40 [*]

Note: = delta or peak stressor period value minus average baseline,

^{*}
 $p < 0.05$.