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Distress tolerance across self-report, behavioral and psychophysiological domains in women with eating disorders, and healthy controls

Angelina Yiu[a], Kara Christensen[b], Jean M. Arlt[a], Eunice Y. Chen[a,*]

[a] TEDp (Temple Eating Disorders program), Department of Psychology, Temple University, 1701 North 13th Street, Philadelphia, PA, 19122, United States
[b] Cognition and Emotion Lab, Ohio State University, 1835 Neil Avenue, Columbus, OH, 43210, United States

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ABSTRACT

Background and objectives: The tendency to engage in impulsive behaviors when distressed is linked to disordered eating. The current study comprehensively examines emotional responses to a distress tolerance task by utilizing self-report, psychophysiological measures (respiratory sinus arrhythmia [RSA], skin conductance responses [SCRs] and tonic skin conductance levels [SCLs]), and behavioral measures (i.e., termination of task, latency to quit task).

Methods: 26 healthy controls (HCs) and a sample of treatment-seeking women with Bulimia Nervosa (BN), Binge Eating Disorder (BED) and Anorexia Nervosa (AN) (N = 106) completed the Paced Auditory Serial Addition Task- Computerized (PASAT-C). Psychophysiological measurements were collected during baseline, PASAT-C, and recovery, then averaged for each time period. Self-reported emotions were collected at baseline, post-PASAT-C and post-recovery.

Results: Overall, we found an effect of Time, with all participants reporting greater negative emotions, less happiness, lower RSA, more SCRs and higher tonic SCLs after completion of the PASAT-C relative to baseline. There were no differences in PASAT-C performance between groups. There was an effect of Group for negative emotions, with women with BN, BED and AN reporting overall higher levels of negative emotions relative to HCs. Furthermore, we found an effect of Group for greater urges to binge eat and lower RSA values among BED, relative to individuals with BN, AN and HCs.

Limitations: This study is cross-sectional and lacked an overweight healthy control group.

Conclusion: During the PASAT-C, individuals with eating disorders (EDs) compared to HCs report higher levels of negative emotions, despite similar physiological and behavioral manifestations of distress.

Eating disorders (EDs) affect up to 4.64% of adults (Le Grange, Swanson, Crow, & Merikangas, 2012) and have significant negative medical and psychosocial outcomes (Baiano et al., 2014). Disordered eating, in general, has been conceptualized as a maladaptive response to alleviate distress (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Anestis, Smith, Fink, & Joiner, 2009; Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007; Fischer, Smith, & Cyders, 2008; Haynos & Fruzzetti, 2011; Leyro, Zvolensky, & Bernstein, 2010). A number of studies use multiple methodologies to examine individuals' with EDs experience of and abilities to withstand negative emotions and/or aversive states, termed distress tolerance. For example, it was found that individuals with Bulimia nervosa (BN) experience greater self-reported sadness in response to stress tasks within achievement and interpersonal domains compared to controls and restrained eaters (Tuschen-Caffier & Vögele, 1999). Another study found that a history of an ED was associated with greater avoidance of affect compared to those without a history of ED (Corstorphine et al., 2007), and that self-reported emotional distress tolerance, but not behavioral and physical forms of distress tolerance, was negatively associated with symptoms of BN (Anestis et al., 2012). A study examining self-reported discomfort induced by hot or cold temperatures did not find differences in hot or cold thresholds between individuals with BN and healthy controls (HCs) after a stress induction task (Schmahl et al., 2010), suggesting similar distress tolerance between BN and HCs. While these studies expand our understanding of the utility of self-report and behavioral measures of distress tolerance in EDs, there is still a lack of literature using psychophysiological measures to assess affective responding in EDs before, during, and after a stressor (Anestis et al., 2007; Anestis, Peterson, et al., 2009; Claes, Vandereycken, & Vertommen, 2005; Peterson & Fischer, 2012; Wenzel, Weinstock, Vander Wal, & Weaver, 2014; Wu et al., 2013).

Research suggests that affective responses encompass subjective

* Corresponding author.
E-mail address: Eunice.Chen@temple.edu (E.Y. Chen).

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experience, physiology and behavior (Gross, 2013), and that multiple methods of assessment are needed in order to gain a comprehensive understanding of affective response when engaged in distress tolerance in EDs. An understanding of the relationship between these three components of an affective response in EDs is particularly important due to the behavioral dysregulation observed in EDs (e.g., fasting, purging, excessive exercise, binge eating). However, there are few studies that utilize this approach, and any relationship between the psychophysiological components of emotional responding and the behavioral components in EDs remains unclear (Gross, 2013; Lang, Greenwald, Bradley, & Hamm, 1993).

The psychophysiological component of emotional response is comprised of parasympathetic and sympathetic nervous system activity. Parasympathetic nervous system activity can be indexed by examining vagal activity, which includes heart rate variability (HRV) and respiratory sinus arrhythmia (RSA), which consists of HRV in conjunction with respiration. Neuroimaging studies show that there is a positive relationship between vagal activity and increased activation in neural structures implicated in effective emotion processing and physiological aspects of emotional responses (e.g., right pregenual anterior cingulate, right subgenual anterior cingulate and right rostral medial prefrontal cortex and the left sublenticular extended amygdala or ventral striatum) (Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012). Low resting vagal activity, decreased vagal activity when emotionally aroused, and a slow return to baseline after emotional arousal are associated with greater symptoms of psychopathology (Beauchaine, 2015). Although reduced resting vagal activity is theorized as a risk factor for psychopathology (Crowell, Beauchaine, & Linehan, 2009), systematic reviews and meta-analysis suggest that higher resting vagal activity is paradoxically associated with both BN (Peschel et al., 2016) and Anorexia Nervosa (AN) (Mazurak, Enck, Muth, Teufel, & Zipfel, 2011) compared to controls. Current research suggests that higher resting vagal activity in BN and AN may reflect the physiological changes associated with disordered eating behaviors (Peschel et al., 2016), though further research is needed to clarify the contributions of psychological symptoms and physiological consequences of disordered eating.

Experimental work examining RSA response to stressors among individuals with EDs has produced mixed findings. Two separate studies found that women with Binge Eating Disorder (BED) and obesity (Friederich et al., 2006) and women with BN (Messerli-Bürgy, Engesser, Lemmenmeier, Steptoe, & Laederach-Hofmann, 2010) showed decreased RSA levels with a slow return to baseline following a psychological stress induction task. The observed decrease in RSA levels with a slow return to baseline suggests difficulty in modulating emotional arousal both during and after a stressor. However, there is contrary evidence that RSA levels among women with BED and obesity remain unchanged after psychological stress was induced (Messerli-Bürgy et al., 2010) and that RSA levels of women without EDs who are obese return to baseline levels after stress exposure (Messerli-Bürgy et al., 2010). This suggests that women without EDs who are obese exhibit physiological emotion modulation as evidenced by a return of RSA levels to baseline levels after stress exposure, but that women with BED and obesity are physiologically unresponsive to stress exposure. Additional research points to engagement in clinically significant levels of binge eating, rather than weight status, for decreased RSA after psychological stress (Udo et al., 2014).

The sympathetic nervous system response can be indexed by skin conductance, which measures the time it takes for a current to pass through the skin (Boucsein et al., 2012). Higher skin conductance responses (SCRs) and levels (SCLs) are associated with greater emotional arousal (Kreibig, 2010; Lang et al., 1993). SCRs reflect the number of times emotional arousal changes from baseline within a given time period and SCLs reflects an individual's overall level of emotional arousal within a given period of time. In contrast to the mixed relationship between RSA and EDs, evidence suggests that SCL are similar between women with BN and BED in response to different stressors (Hilbert, Vögele, Tuschen-Caffier, & Hartmann, 2011). SCLs are also similar between women with BN, women with self-reported restrained eating and HCs (Tuschen-Caffier & Vögele, 1999). Taken together, there is some evidence to suggest that there is a relationship between EDs and decreased RSA when psychological stress is induced, and limited evidence pointing to a relationship between EDs and sympathetic responses as indexed through skin conductance. The concurrent examination of parasympathetic and sympathetic responses is warranted, as there is evidence to suggest that sympathetic responses are associated with negative affect following exposure to emotional stimuli; even when cardiac measures did not change significantly (Boucsein et al., 2012; Salters-Pedneault, Gentes, & Roemer, 2007).

Thus far, the evidence base for the psychophysiological component of emotional response while distressed across the range of EDs has been mixed, limited by small sample sizes, and there is a lack of research utilizing multiple ED diagnoses. The current study extends past research (Leehr et al., 2015; Naumann, Tuschen-Caffier, Voderholzer, Caffier, & Svaldi, 2015; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012a; Svaldi, Tuschen-Caffier, Lackner, Zimmermann, & Naumann, 2012b) through the multi-modal assessment of emotional responses across three common ED diagnoses and HC participants to a commonly used behavioral distress tolerance task. The Paced Auditory Serial Addition Task-Computerized (PASAT-C) (Lejuez, Kahler, & Brown, 2003) was used as a behavioral measure of distress tolerance (Feldner, Leen-Feldner, Zvolensky, & Lejuez, 2006; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006) and self-reported emotions and psychophysiological measures of arousal were measured in response to the PASAT-C. As individuals with EDs have been argued to have, “shared, but distinctive, clinical features […] maintained by similar psychopathological processes,” utilizing a transdiagnostic approach that includes three ED groups may be most useful in identifying the proposed “similar psychopathological processes” (Fairburn, Cooper, & Shafran, 2003).

We predicted a main effect of time, such that self-reported negative emotions would be greater, happiness would be lower, and urges to binge eat would be greater after the PASAT-C, in comparison to baseline and at recovery. Based on prior research (Anestis et al., 2007; Corstorphine et al., 2007; Tuschen-Caffier & Vögele, 1999), we expected that diagnostic group would moderate this effect. Specifically, we expected that HCs would demonstrate less significant changes in negative emotions, happiness, and urges to binge eat during the PASAT-C, compared to individuals with BN, BED, or AN. As the PASAT-C is used as a behavioral distress tolerance measure (Gratz et al., 2006; Sauer & Baer, 2012), we expected that individuals with BN, BED, and AN would be more likely to prematurely terminate the PASAT-C and exhibit shorter latency to terminate the PASAT-C than HCs. Given the proposed role of negative affect in EDs during distress (Anestis et al., 2007; Anestis, Smith, et al., 2009; Peterson & Fischer, 2012), we expected that RSA values would be lower and SCRs and tonic SCL values would be higher during the PASAT-C in ED groups compared to HC, relative to baseline and recovery.

1. Methods

1.1. Participants

Participants were self-referred from the community using flyers, referred from local eating disorder clinics and student health and counseling services, and recruited in a University-based outpatient eating disorder program as part of several clinical trials. Participants were invited to participate in the study if, after undergoing a clinical interview (described below) they met for a diagnosis of BN, BED, or AN (typical or atypical), without current drug or alcohol dependence or symptoms of psychosis. HCs were self-referred from the community, student health and counseling services, and the University Hospital, and were eligible to participate if, after undergoing the same clinical