EMPIRICAL ARTICLE

Individual Differences in Negative Affect and Weekly Variability in Binge Eating Frequency

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ABSTRACT

Objective: To examine the relationship of neuroticism and negative affect (NA) lability with weekly binge eating fluctuations between binge eating disorder (BED) and bulimia nervosa (BN).

Method: Individuals with BED (n = 30) and BN (n = 54) from the community completed self-report measures at baseline and prospectively for 12 consecutive weeks. Weekly data were analyzed by using (mean) squared successive deviation to account for fluctuations in NA and binge eating from week to week.

Results: Generalized estimating equations revealed the presence of a two-way interaction between neuroticism and NA lability predicting binge eating fluctuations (Wald \( \chi^2 = 8.25; df = 1; p = .004 \)), indicating that higher NA lability was only related to larger fluctuations in the frequency of binge eating episodes when present in individuals who were also high on neuroticism. An interaction was also detected between eating disorder diagnosis and NA lability, but this was accounted for by differences in average NA between the diagnoses.

Discussion: This study highlights the relevance of two traits and their interaction in understanding individual differences in binge eating fluctuations. Additionally, findings indicate that diagnostic differences in average NA may impact binge eating fluctuations and NA lability. © 2013 Wiley Periodicals, Inc.

Keywords: binge eating; neuroticism; NA lability; bulimia nervosa; binge eating disorder

Introduction

Binge Eating Disorder (BED) shares a fundamental criterion with bulimia nervosa (BN), specifically binge eating. Binge eating is defined as the sense of loss of control when consuming an unusually large amount of food.¹ Research indicates that individuals with BED and BN report comparable binge size, duration, and feeling a loss of control.² In addition, there appear to be similarities across BN and BED in the experience of NA prior to binge eating (see Ref. ³ for thorough description of research in this area). NA has been identified as a trigger for binge eating episodes in retrospective reports by mixed eating disorder samples,⁴,⁵ ecological momentary assessments by both individuals with BN and BED⁶ and experimental induction by participants with BED.⁷

NA can fluctuate greatly from moment-to-moment, and some individuals are more prone to these fluctuations. Two personality traits that are conceptually and empirically related to the experience of NA are neuroticism and affect lability. Neuroticism is the tendency to have a strong negative emotional reaction to stress and has been associated with eating disorder symptom severity.⁷ Similarly, affect lability describes the tendency to experience emotions that rapidly change both in strength and valence and has been noted to be associated with binge eating episodes in a community sample of women who binge eat.⁸ Although affect lability and neuroticism are similar, Miller and Pilkonis⁹ reported evidence that they are distinct constructs. In an inpatient and outpatient psychiatric sample, neuroticism was found to be strongly related to anxious and avoidant tendencies and was predictive of symptom development, occupational impairment, and global dysfunction, whereas affect lability was related to externalizing personality tendencies and predicted romantic impairment. Both affect lability and Neuroticism measure individual differences in the experience of NA.

Affect lability has been associated with more severe eating disorder pathology⁸,¹⁰ and has been
found to predict binge eating episodes on a given day in a sample of participants with BN.\textsuperscript{11} A recent study found that, compared to individuals with anorexia nervosa-restricting type (ANr), individuals with BN experienced more variability in affective states (i.e., experienced more changes from high NA to low NA\textsuperscript{12}). However, little is known about differences in affect lability between BN and BED. Instead, most research in this area has focused on the relationship of state NA and binge eating, which is an episodic behavior that demonstrates great variability in frequency both over the short-term\textsuperscript{13} and long-term.\textsuperscript{14}

Research has found that individuals with BN experience greater NA in general compared to individuals with BED.\textsuperscript{15,16} Hilbert and Tuschen-Caffier\textsuperscript{15} examined the affective antecedents to binge eating for women diagnosed with BED or BN. Although both groups reported more NA before binge eating than before regular eating, the BN group experienced even greater antecedent NA than the BED group and greater overall NA. Conversely, a meta-analysis (\(N = 968\)) of 36 ecological momentary assessment studies found larger effect sizes for antecedent NA in BED compared to BN.\textsuperscript{3} Although empirical support is limited, Haedt-Matt and Keel\textsuperscript{3} hypothesized that individuals with BN experience chronically high NA. Therefore, a smaller increase in state NA may be required to trigger binge eating. This may have caused individuals with BED to appear to have greater antecedent NA because of larger changes in state NA, when in fact individuals with BN required a smaller trigger (i.e., experience a smaller change in NA before a binge eating episode). In other words, individuals with BN may experience less variable and more elevated NA prior to binge eating compared to individuals with BED. Because changes in state NA have been found to be strong predictors of binge eating episodes, individual differences in the experience of NA between BN and BED may suggest different vulnerabilities for the occurrence of binge eating episodes. Understanding these vulnerabilities may inform the selection and delivery of effective treatments for these disorders, especially in light of an increasing focus on the role of emotion regulation in eating disorder treatments.\textsuperscript{17,18}

The purpose of this study was to examine neuroticism and affect lability to determine whether these traits are associated with variability in the frequency of binge eating episodes over a 12-week period. In addition, this study aimed to examine whether these relationships differ between BN and BED, two clinically significant eating disorders that share binge eating as a primary behavioral pathology.

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**Method**

**Participants**

A community sample of individuals with eating disorders from 34 states and the District of Columbia were recruited from a university campus and surrounding community and through internet postings on craigslist.org. The current study included individuals who reported binge eating and purging (\(n = 54\)) or binge eating alone (\(n = 30\)). Most participants were women (\(n = 67, 79.8\%\)). The majority self-identified as Caucasian (\(n = 58, 69\%\)), followed by Asian/Pacific Islander (\(n = 9, 10.7\%\)), Hispanic (\(n = 8, 9.5\%\)), Black/African American (\(n = 6, 7.1\%\)), Other/mixed (\(n = 2, 2.4\%\)), and Native American (\(n = 1, 1.2\%\)). Participants’ ages ranged from 18 to 62 years, with a mean (SD) of 33.69 (12.98) years.

**Measures**

**Eating Disorder Diagnostic Scale.** The Eating Disorder Diagnostic Scale (EDDS)\textsuperscript{19} is a 22-item self-report questionnaire that assesses eating pathology for DSM-IV eating disorder diagnoses assignment. The EDDS is highly specific and sensitive for eating disorder diagnoses.\textsuperscript{20}

**Eating Disorder Examination—Questionnaire.** The Eating Disorder Examination—Questionnaire (EDE-Q)\textsuperscript{21} is a 28-item self-report questionnaire that provides indicators of eating-related psychopathology from four subscales: Dietary Restraint, Eating Concern, Shape Concern, and Weight Concern. In addition, this scale assesses the frequency of binge eating, purging, fasting, and driven exercise over the previous four weeks.

**Big Five Personality Inventory.** The Big Five Personality Inventory (BFI)\textsuperscript{22} is a 44-item self-report questionnaire that evaluates personality on the following five dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to new experience. Individuals rate each item on a five-point scale from “disagree strongly” to “agree strongly” for how much they believe the item is characteristic of them. Raw scores were converted to T-scores using age-appropriate norms.\textsuperscript{23}

**Positive and Negative Affect Schedule.** The Positive and Negative Affect Schedule (PANAS)\textsuperscript{24} assesses positive and NA. Using a five-point scale from “Very slightly or not at all” to “Extremely,” individuals rate the degree to which 20 affect-laden words describe how they have felt during a period of time. In the present study, participants completed the PANAS with instructions for how they felt “in general” at the baseline, 6-week, and 12-week assessments and how they felt over “the past week” at each of the 12 weekly assessments.
Weekly Self-Monitoring Questionnaire. The frequency of binge eating, purging, fasting, and exercise motivated by feeling bad about one’s weight or shape over the previous week were assessed using wording that is similar to the EDDS. Weekly body weight in pounds was also reported.

Design and Procedures

The design and procedures of the current study were reviewed and approved by an institutional review board and participation included informed consent. The EDDS was used to assess eligibility and derive eating disorder diagnoses. The BFI, EDE-Q, and PANAS were completed along with a number of other measures at baseline. Participants then completed the Weekly Self-Monitoring Questionnaire and the PANAS weekly for 12 consecutive weeks. Participants were compensated monetarily for their participation.

The principal investigator (KD) screened interested participants over the telephone using the EDDS for the following inclusion criteria: (1) at least 18 years of age and (2) the presence of an eating disorder as indicated by at least one of the following: (a) the presence of purging (i.e., self-induced vomiting, laxative, diuretic, or enema misuse, or the abuse of medication such as insulin) at least once every two weeks and undue influence of body weight or shape on self-evaluation or marked distress about purging, or (b) the presence of binge eating episodes at least once per week and undue influence of body weight or shape on self-evaluation or marked distress about binge eating. Individuals diagnosed with BN reported both 2a and 2b; individuals diagnosed with BED reported only 2b. All participants in the current study reported body weights that resulted in body mass indices at or above 18 kg/m².

Data Analysis

The Mean square successive deviation (MSSD) was used to quantify NA lability, a method that has demonstrated validity in previous research. The MSSD quantifies an individual’s average change on a particular variable from one point in time to another. The MSSD measures variability based on each point in time compared to the point in time that immediately preceded it. These variations are then averaged to create an estimate of participants’ standing on the trait of NA lability. This procedure is in contrast to typical methods of aggregating measurements of variability and deriving a simple mean, which treat variability as error and result in an estimate of trait NA. Consequently, MSSD produces a singular index for each participant that represents the degree to which a particular variable shifts from measurement to measurement. The NA lability MSSD represents the average degree to which each participant’s level of NA differed from the level that preceded it, calculated as follows where there are n number of elements, the ith of which is denoted by xi:

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MSSD = \frac{\sum_{i=1}^{n-1} (x_{i+1}-x_i)^2}{n-1}
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The dependent variable, variability in binge eating frequency, was calculated using squared successive deviations (SSD). The SSD follows the same formula as the MSSD, but does not average the deviations for a measure of central tendency (i.e., the numerator is not divided by \(n - 1\)). Instead SSD allows for the use of a statistical analysis (i.e., generalized estimating equation) that models within-individual variability that is attributable to measurement error rather than averaging it out, resulting in increased statistical power. Binge eating SSD represents the degree to which each participant’s number of binge eating episodes differed from one week to the next.

Data were analyzed using generalized estimating equations (GEE). The SSD for binge eating episodes measured over a period of 12 weeks via the Weekly Self-Monitoring Questionnaire (WSMQ) was the dependent variable. The data were fit using a negative binomial response function. The independent variables were NA lability (i.e., MSSD calculated from weekly affect reported via PANAS), neuroticism as measured by the BFI, and eating disorder diagnosis as assessed by the EDDS. Age, BMI, and binge eating frequency at baseline as assessed by the EDE-Q were also included as covariates. All two- and three-way interactions were included for NA lability, neuroticism, and eating disorder diagnosis. To confirm that these results were not because of differences in average NA between individuals with BN and BED, a subsequent model included average NA calculated by averaging weekly PANAS NA.

Eating disorder diagnosis was mean-centered, such that high scores indicate BN and low scores indicate BED. A random intercept, which allows individuals to vary about their own average binge eating SSD, was included in the model. Parameters were evaluated with statistical significance set at \(p < .05\). The covariance structure was specified as autoregressive. Missing data were presumed to be missing at random (MAR; see Ref. 28, p. 158).

The GEE was conducted in a step-wise fashion. The first model included diagnosis, neuroticism, NA lability, and their two- and three-way interactions in addition to age, baseline binge eating frequency, and BMI as covariates. Baseline binge eating frequency was included as a covariate because it is related to variability in weekly binge eating frequency such that individuals who report low-frequency binge eating cannot demonstrate as much variability as individuals who (at least occasionally) report higher frequency binge eating. Additionally, age
was included as a covariate in order to control for age-related changes in the nature of the relationships under investigation.

**Results**

The sample was comprised of a diverse group of individuals from the community. Sex was significantly different between diagnoses ($\chi^2 (1) = 4.96, p = .026$), with a greater proportion of women ($n = 47$) to men ($n = 7$) diagnosed with BN compared to BED (women $n = 20$, men $n = 10$). Ethnicity was not significantly different between diagnoses ($\chi^2 (5) = 9.91, p = .078$). Of the 84 individuals who completed the baseline assessment, 71 participants completed at least two PANAS NA assessments, which was the minimum requirement for inclusion in the GEE analysis. Of these 71 participants, 47 (66.2%) completed all 12 weekly assessments of the PANAS NA and an additional 8.5% completed 11 of the 12. Mean (SD) prior to centering of age, BMI, baseline binge eating frequency, neuroticism, NA lability MSSD, and average NA are reported in Table 1. Independent samples $t$-tests revealed no differences between BN and BED on these variables.

The results of the GEE indicated the presence of a significant interaction between NA lability and neuroticism ($\chi^2 = 2.98; df = 1; p = .042$). The three-way interaction between diagnosis, NA lability, and neuroticism was not significant, so the analysis was rerun after removing it. In the resulting model, there was a significant main effect of NA lability and significant interaction of NA lability and neuroticism (Table 2; Fig. 1A). Individuals displaying greater NA lability (i.e., +1SD) who were also high on neuroticism (+1SD) reported week-to-week changes in binge eating frequency that were approximately 0.84 episodes larger than individuals low on NA lability and 0.67 larger than individuals low on neuroticism, regardless of NA lability. There was also a significant interaction between NA lability and diagnosis (Table 2; Fig. 1B). Individuals with BN who were low on NA lability (i.e., −1SD) reported week-to-week changes in binge eating frequency that were approximately 1.48 episodes larger than individuals high on NA lability, 1.74 episodes larger than individuals with BED who reported high levels of NA lability, and 1.96 episodes larger than individuals with BED who reported low levels of NA lability. To test whether these results were because of differences in average NA, average weekly NA was added to the model as a covariate ($\chi^2 = 2.76; df = 1; p = .097$). Subsequently, only the two-way interaction between neuroticism and NA lability remained significant ($\chi^2 = 11.50; df = 1; p < .001$).

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1Sex was added to the model as a covariate in a supplemental analysis, but there was no main effect of sex ($\chi^2 = 1.48, p < 0.288$) and the inclusion of sex did not change the nature of the interactions.
**Discussion**

The purpose of this study was to evaluate the role of neuroticism and NA lability in predicting variability in binge eating frequency in BED and BN. The results revealed an interaction in which the strength of the link between neuroticism and variability in binge eating frequency depended on individuals’ standing on NA lability. In addition, a second interaction between NA lability and diagnosis was present but appeared to be accounted for by differences in average levels in NA between BN and BED.

Individuals higher on neuroticism and NA lability reported more variability in the frequency of their binge eating episodes. In other words, individuals who reported larger changes in the frequency of binge eating episodes from one week to the next (e.g., experience one binge eating episode during week 1 and five binge eating episodes during week 2) were more likely to experience larger shifts in NA and score higher on neuroticism. Among individuals with low NA lability, neuroticism appeared not to be associated with variability in weekly binge eating frequency.

Another apparent interaction between diagnosis and NA lability was accounted for by a diagnostic difference in average NA. Before accounting for average levels of NA, it appeared as though individuals with BN who were low on NA lability experienced more variability in the frequency of binge eating episodes than individuals with BED, in whom the influence of NA lability was less dramatic but similar to what was observed in BN. This rather contradictory finding highlights the importance of accounting for average levels of NA. This finding is consistent with Haedt-Matt & Keel's hypothesis that individuals with BN may experience a ceiling effect of NA and require a smaller increase in NA to trigger binge eating.

Specific limitations of this study should be noted when interpreting these findings. First, data were collected at the week-level, which may be less able to capture the nuanced nature of the relationship between affect and binge eating compared to more frequent assessment intervals. Increasingly, momentary data collection methods have been utilized as a means to understanding factors precipitating the occurrence of disordered eating behaviors. Although the present study cannot examine momentary relationships, the results provide support for the relevance of two personality traits that describe the experience of NA (i.e., neuroticism and NA lability), which appear to jointly account for week-to-week changes in binge eating frequency. Furthermore, the current study used a method of quantifying week-to-week variability (i.e., the SSD) that represents a unique strength. These findings compliment research explaining variability about an average binge eating frequency, which address factors that influence the overall level, rather than magnitude of change, in binge eating frequency. Additionally, the data collection environment was not controlled because of the online data collection technique utilized; however, this method also provided a diverse community sample from across the United States representing a variety of ages and ethnicities.

The results of this study suggest that neuroticism and NA lability, two traits that describe the experience of NA, predict variability in weekly binge eating frequency for individuals with BN and BED. The results also suggest that treatments focusing on emotion dysregulation may be pertinent to the care of individuals presenting clinically with BN or BED who report large changes in the week-to-week frequency of binge eating episodes. Future research, using momentary data collection methods may benefit from incorporating these dispositional characteristics alongside momentary measures of affect to understand the occurrence of binge eating episodes. Future research should also continue to examine differences in the nature of binge eating across the eating disorders and test whether the presence of purging or other eating disorder behaviors exerts an impact on the relationship between dispositional and state variables and binge eating. The findings of such investigations may influence theoretical models of risk and maintenance as well as treatment approaches.
References


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