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Associations between Negative Affect and Binge/Purge Behaviors in Women with Anorexia Nervosa: Considering the Role of Negative Urgency

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Abstract

Objective—Evidence implicates negative affect in the occurrence of binge/purge behaviors, although the extent to which theoretically relevant individual difference variables may impact this association remains unclear. Negative urgency, the dispositional tendency to engage in rash action when experiencing negative affect, is a unique facet of impulsivity that may play a key role. Moreover, it was hypothesized that women with anorexia nervosa (AN) who are higher on measures of negative urgency, relative to those lower on negative urgency, would exhibit: 1) greater binge eating and purging frequencies on high negative affect days, and 2) a greater change in negative affect prior to and following binge eating and purging episodes.

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Disclosure of Conflicts

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Method—Women with AN (n = 82) completed a self-report measure of negative urgency and a 2-week ecological momentary assessment protocol in which they recorded binge eating, purging, and negative affect ratings.

Results—Women with higher levels of negative urgency exhibited a greater frequency of binge eating and purging; however, in comparison to women low on negative urgency, they: 1) were more likely to binge eat on days corresponding with low-to-moderate negative affect (similar rates of binge eating were observed on high negative affect days), and 2) displayed substantially elevated levels of negative affect across time, and thus, smaller degrees of change in negative affect prior to and following binge eating and purging episodes.

Discussion—Negative urgency underlies individual differences in the daily experience of negative affect. Women with AN who are high on negative urgency may have an increased propensity for binge eating and purging via a relatively persistent and heightened state of negative emotions.

Keywords

Anorexia nervosa; binge eating; purging; negative urgency; negative affect; ecological momentary assessment

1. Introduction

Anorexia nervosa (AN) is largely characterized by fear of fatness and/or weight gain and severe dietary restriction resulting in an abnormally low body weight.¹ The two diagnostic subtypes of AN are characterized by either the presence (binge-eating/purging; ANbp) or absence (restricting; ANr) of recurrent episodes of binge eating and/or purging.¹ Despite evidence suggesting that a relatively large proportion of individuals with AN develop binge eating or purging behaviors^{2,3}, research aimed at identifying factors that contribute to the momentary occurrence of these behaviors in AN has been relatively scarce.

Negative affect is one variable that has been identified as an important factor in various theoretical and treatment models of anorexia nervosa.⁴⁻⁸ Although the specific focus of each of these models varies, a common theme is that individuals with AN engage in eating disorder behaviors (i.e., binge eating, purging, restriction) to regulate, avoid, or escape aversive affective states.⁴⁻⁸ Empirical evidence supports this supposition, with findings suggesting increasing negative affect preceding and decreasing negative affect following binge eating and/or purging episodes in women with AN.⁹ However, the relative influence of negative affective states on binge eating and purging behavior in AN may vary based upon theoretically relevant individual difference constructs, as has been demonstrated in bulimia nervosa¹⁰ (i.e., between-person variation in impulsivity altered anger-binge eating associations). Examining the role of such variables would aid in identifying those individuals who may be more susceptible to engaging in binge eating and purging in response to the experience of negative affect.

Negative urgency, a unique facet of impulsivity defined as the dispositional tendency to act rashly when emotionally distressed,¹¹ may have specific relevance for understanding individual differences in the link between negative affect and binge/purge behaviors in

women with AN. Indeed, negative urgency encompasses the intersection of rash-action *and* negative emotionality, and data have demonstrated that negative urgency is the most predictive form of impulsivity for binge eating and purging behavior (e.g., stronger predictive effects than sensation seeking, lack of persistence, lack of planning, and positive urgency).¹²⁻¹⁴ Negative urgency has also been shown to be a prospective risk factor for the development of bulimic-type symptoms¹⁵⁻¹⁶ and to differ across eating disorder diagnoses as a function of the presence and frequency of binge eating and purging behaviors, with highest levels of negative urgency observed in individuals with bulimia nervosa, intermediate levels in individuals with ANbp, and lowest (and within the normal range) in individuals with ANr.¹⁷ Given these findings, investigating the interplay between negative urgency and negative affective experiences surrounding binge/purge behaviors may be a promising area of study.

Existing evidence from these separate but related areas of research points to an intriguing hypothesis: women with AN who have high levels of negative urgency may be particularly vulnerable to engaging in binge eating and purging in the face of negative affect. The current investigation aimed to test this hypothesis by capitalizing on the strengths of ecological momentary assessment (i.e., repeated, real-time assessments in the natural environment). Specifically, this study explored whether the associations between negative affect and binge/purge behaviors in women with AN vary based upon individual differences in negative urgency, utilizing both between-day (i.e., daily variation in negative affect-behavior frequency) *and* within-day (i.e., trajectories of negative affect surrounding behaviors) models. It was hypothesized that women with higher levels of negative urgency (compared to those with lower levels) would exhibit: 1) a greater frequency of binge eating and purging episodes, particularly on days corresponding to higher levels of negative affect (see Figure 1a), and 2) greater changes in negative affect prior to and following binge eating and purging episodes (see Figure 1b).

2. Methods

2.1. Participants

Participants were 82 late adolescent/adult females (ages 18-58; M age = 25.23, SD = 8.69) who met DSM-IV criteria for AN (n = 38) or subthreshold AN (n = 44). Subthreshold cases were defined as meeting all DSM-IV criteria except (1) body mass index between 17.5 and 18.5 kg/m² or (2) no amenorrhea or no body image disturbance and intense fear of fat, consistent with the broadening of diagnostic criteria that were anticipated to occur with the DSM-5.¹ Based on baseline diagnostic interviews, a total of 57 (69%) participants were classified as ANr and 25 (31%) were classified as ANbp; however, fifty percent of participants (n = 41) reported at least one binge eating or purging episode throughout the duration of the study (binge eating and purging, n = 23; binge eating only, n = 11, purging only, n = 7). Notably, sample sizes were smaller for within-day analyses (binge eating, n = 34; purging, n = 30) than between-day (n = 82) analyses given methodological differences. Within-day models estimate changes in negative affect pre- and post-behavior so only participants that engaged in binge eating or purging behaviors could be included in those

analyses, whereas between-day models could estimate daily binge eating or purging frequency effects (frequency range = 0-7) across all participants.

Participants were recruited at three sites from April 2006 to July 2010: 1) Neuropsychiatric Research Institute, Fargo, ND, 2) University of Minnesota, Minneapolis, MN, and 3) University of Chicago, Chicago, IL. Recruitment methods included newspaper, radio, TV, or internet advertisements (24%), flyers (39.4%), clinical referrals (28%), and other (e.g., referred by family or friends) or more than one recruitment method (8.5%). Of the 601 individuals who completed phone screens, 256 (43%; 256/601) met initial inclusion/exclusion criteria (i.e., possible full or subthreshold AN; not pregnant or breast feeding; not in a new treatment, taking a new psychotropic medication, recently hospitalized, or suicidal; not alcohol/drug dependent; no history of gastric bypass/gastrointestinal surgery). A total of 166 women (65%; 166/256) completed additional in-person evaluations, and 121 (73%; 121/166) continued to meet eligibility criteria and agreed to participate in the study.

Data were excluded from a small number of participants ($n = 3$) who had study compliance rates of less than 50% (average ecological momentary assessment compliance rates ~87-89%).⁹ Additionally, the negative urgency measure was added to the study protocol after data collection began, and thus, the current study includes only participants ($n = 82/118$, 69.5% of total sample) with negative urgency data. Participants included in this study therefore overlap with, but are only a subset of, the sample reported in Engel et al.⁹ Notably, the subset of participants who completed the negative urgency measure ($n = 82$) did not significantly differ from participants without negative urgency data ($n = 36$) in terms of binge eating and purging frequency, levels of negative affect, or demographic characteristics (age, body mass index, ethnicity, or total household income; p 's = .32-.85), and therefore appear to be representative of the full sample.⁹ There were also no significant differences between participants from the three recruitment sites on independent/dependent variables or demographic characteristics (p 's = .20-.96); thus, it is unlikely that results would be unduly impacted by the use of a combined sample across recruitment sites.

Participants had a mean body mass index of 17.11 kg/m² (SD = 1.16; range = 13.4-18.5), were predominantly Caucasian (97.6%), single/never married (73.2%), and had at least some college education (87.8%). Approximately half of the sample (55.5%) reported a total household income \$30,000.

2.2. Procedures

This study was approved and conducted in compliance with the Institutional Review Board at each site. Participants attended two laboratory visits during which written informed consent was obtained, structured interviews and self-report measures were completed, training on the use of the palmtop computers was delivered, and a medical screening (e.g., vital signs, laboratory screening, physical exam) was conducted to ensure medical stability. Participants carried palmtop computers for two practice days to ensure familiarity with and to minimize reactivity to the assessments. During a subsequent laboratory visit, feedback regarding compliance during the practice days was given. Practice data were not included in data analysis. Following the practice period, participants were given a palmtop computer and instructed to complete momentary recordings over the next two weeks, during which

time 2-3 additional laboratory visits were scheduled to obtain recorded data. Compliance rate feedback was given to participants at each visit. At the end of the two-week assessment period, participants were compensated up to \$250 (i.e., \$100/week, plus an additional \$50 if they responded to 80% of signals within 45 minutes) for completing the study.

The current study collected three types of daily ecological momentary assessment data: signal-contingent, interval-contingent, and event-contingent. Using a *signal-contingent* approach, participants were signaled at six semi-random times throughout the waking hours of day to complete recordings of negative affect eating disorder behaviors not previously recorded. Signal times were semi-randomly selected times around “anchor points” that subdivided the day into six equivalent time blocks: 8:30 a.m., 11:10 a.m., 1:50 p.m., 4:30 p.m., 7:10 p.m., and 9:50 p.m. In addition to signal contingent recordings, participants were asked to complete *interval-contingent* recordings at a fixed time each day (i.e., before bedtime) and *event-contingent* recordings following the occurrence of an eating disorder behavior (e.g., binge eating, purging).

2.3. Measures: Baseline Assessment

2.3.1. Eating Disorder Diagnosis—The Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition (SCID-I/P)¹⁸ was used to determine a DSM-IV diagnosis of AN or subthreshold AN. All SCID interviews were audio recorded and inter-rater reliability was conducted on a random subset of interviews (n = 30, 25% of total sample). Inter-rater reliability for current AN diagnosis was excellent ($\kappa = .93$).

2.3.2. Negative Urgency—Negative urgency (i.e., the tendency to act rash in response to negative affect) was assessed at baseline using the Negative Urgency subscale from the UPPS Impulsive Behavior Scale-Revised (UPPS-R).^{11,19} Items (e.g., “It is hard for me to resist acting on my feelings”) were rated on a 4-point scale ranging from (1) *agree strongly* to (4) *disagree strongly*. An average of all items is calculated such that higher scores indicate greater negative urgency. The alpha coefficient for the negative urgency scale was good in the current study ($\alpha = .85$).

2.4 Measures: Daily Ecological Momentary Assessment

2.4.1. Negative Affect—An abridged version of the Positive and Negative Affect Schedule (PANAS)^{20,21} adapted for ecological momentary assessment administration and used in previous studies (e.g., see Ref. 22) was utilized to assess momentary negative affect (e.g., nervous, afraid, sad, disgusted, distressed, ashamed, angry at self, and dissatisfied with self). Participants rated each item on a 5-point scale ranging from (1) *not at all* to (5) *extremely*. Higher scores indicate higher levels of negative affect. The alpha coefficient for this abbreviated negative affect scale was excellent in the current study ($\alpha = .94$).

2.4.2. Binge Eating—Participants were asked to report any episode of eating, and to identify the type of eating episode (e.g., meal, snack, binge). Participants were given instructions regarding the definition of a binge eating episode. Specifically, an unusually large amount of food was defined as “an amount of food that you consider excessive or an amount of food that other people would consider excessive.” Examples of what constitutes

an objectively large amount of food were provided and personally tailored to each participant's eating habits. Loss of control was defined as “the inability to stop eating,” and feeling driven to eat was defined as “the inability to prevent the eating episode.”

2.4.3. Purging—Participants were asked to report specific compensatory behaviors related to their eating, including self-induced vomiting or laxative use for weight control.

2.5. Statistical Analysis

2.5.1. Between-Day Analyses—For between-day analyses, daily negative affect was calculated as the arithmetic mean of all momentary negative affect scores for each participant on each study day. The binge eating and purging frequency scores were calculated for each study day by summing across daily episodes of the respective behavior.

Generalized Estimating Equations with a negative binomial response function were used to examine whether individual differences in negative urgency were related to differences in the associations between daily negative affect and binge eating and purging frequency (range = 0-7, see Table 1). Level 1 observations were daily negative affect ratings, and Level 2 observations were individual participants and their baseline negative urgency score. These models examined the main effects of negative urgency and negative affect as well as interactive effects of negative urgency \times negative affect on binge eating and purging frequency across days. The interaction was of particular interest to this study, as a significant negative urgency \times negative affect interaction would indicate that the relationship between daily negative affect and binge eating and/or purging frequency varies as a function of individual differences in levels of negative urgency. The numerical value representing the day in the study (e.g., 2 for the second day of recording) was included as a covariate to adjust for potential changes in binge eating and purging frequency over the course of the study. Following recommendations for centering variables in multilevel analysis²³, Level 1 within-subjects variables (i.e., negative affect score, day in the study) were within-person centered (also referred to as group mean or within-cluster centered) and the Level 2 between-subjects variable (i.e., negative urgency score) was grand mean centered.

2.5.2. Within-Day Analyses—Hierarchical Linear Models were used to examine whether individual differences in negative urgency were differentially related to associations between negative affect and binge eating or purging behavior. The within-day trajectory of negative affect was modeled pre- and post-behavior (i.e., binge or purge episode) using linear, quadratic, and cubic functions centered on the time that the eating disorder behavior occurred. Negative urgency was grand mean centered and included as a factor that could interact with the linear, quadratic, and cubic functions of temporal changes in negative affect. Linear functions (i.e., hours prior to and hours following behavior) reflected the *rate of change* in negative affect prior to and following binge eating or purging. Quadratic functions (i.e., (hours prior to behavior)², (hours following behavior)²) reflected the *acceleration in rate of change* in negative affect prior to and following binge eating or purging. Cubic functions (i.e., (hours prior to event)³, (hours following event)³) reflected further acceleration or dampening of the acceleration in rate of change in negative affect. These models allowed us to distinguish whether the negative affect curves (i.e., changes in

levels of negative affect) around binge eating or purging episodes differed as a function of individual differences in negative urgency.

All momentary negative affect ratings that occurred on the day of the binge eating or purging episode were included in statistical analyses, up until the occurrence of a second binge eating or purging episode on the same day. Moreover, consistent with prior research,²² statistical models aimed to avoid confounding the effects of antecedent and consequent mood ratings on binge eating or purging behavior within a day. Thus, if multiple binge eating or purging behaviors were reported in a single day, the within-day statistical analyses included only the first behavior of the day. If subsequent binge eating or purging episodes were reported within the first four hours following the initial binge or purge episode, post behavior analyses only included ratings of negative affect that occurred during the duration of time spanning the first and second episode.²²

3. Results

3.1. Descriptive Statistics

Participants provided 10,469 response ratings (i.e., 6,287 responses to random signals, 3,166 event recordings of behaviors, and 1,016 end-of-day recordings) for negative affect, binge eating, and purging. Participant compliance (signal-contingent: average = 86.84%, median = 91.03%; end-of-day: average = 89.27%, median = 93.54%) and timeliness (i.e., on average, participants answered signals within 16 minutes, \pm SD = 25 minutes) for completing ratings were good. Further, as noted previously⁹, compliance rates were not associated with our independent or dependent variables or with the majority (95%; 53/56) of baseline demographic and clinical characteristics, suggesting that analyses and results are not biased by missing data.

Consistent with prior research^{24,25}, Pearson correlations indicated a moderate positive association between negative urgency and daily negative affect ($r = .37$), indicating that higher levels of negative urgency are associated with higher levels of negative affect in the natural environment. Nonetheless, although these constructs overlap, it is important to note that they are largely unique from one another (current study: $r^2 = .14$; 14% of variance shared).^{24,25} Additionally, mean levels of negative urgency and negative affect were significantly higher (medium-to-large effect sizes; $d' = .64-.82$) in participants who exhibited binge eating and/or purging episodes during the ecological momentary assessment period as compared to participants without any reported binge eating or purging episodes (see Table 1).

3.2. Between-Day Analyses

Results from between-day analyses are shown in Table 2 and Figure 2. Negative urgency and daily negative affect significantly interacted to predict binge eating frequency across days. However, in contrast to study hypotheses, individual differences in negative urgency predicted differences in the frequency of binge eating on days corresponding to *lower* (as opposed to higher) levels of negative affect. Binge eating episodes therefore occurred more frequently on days corresponding to higher levels of negative affect, regardless of

differences in negative urgency. Thus, compared to women with lower levels of negative urgency, women with higher levels of negative urgency tended to exhibit less between-day differences in the frequency of binge eating (i.e., they had a propensity to engage in more binge eating, even on days corresponding to relatively lower levels of negative affect).¹

Negative urgency and daily negative affect also significantly interacted to predict purging frequency across days (see Table 2). However, as shown in Figure 2, the pattern of results largely reflected main effects of negative urgency and daily negative affect on purging frequency (e.g., interaction effects could not be detected until the graphs were plotted according to 3 or 4 standard deviations above or below the mean). Specifically, purging episodes occurred more frequently on days corresponding to higher levels of negative affect, and women with higher levels of negative urgency reported more purging episodes across days.

3.3. Within-Day Analyses

The within-day trajectories of negative affect in the hours prior to and following binge eating or purging episodes are shown in Table 3 and Figure 3. Negative affect increased before and decreased after binge eating and purging episodes (see linear, quadratic, and cubic estimates in Table 3). Individual differences in negative urgency were associated with significant differences in these trajectories for binge eating (see linear and quadratic estimates for negative urgency \times negative affect interactions in Table 3); however, in contrast to initial hypotheses, the relative change in negative affect prior to and following binge eating episodes was significantly greater for women with lower levels of negative urgency. Interestingly, women with higher levels of negative urgency exhibited substantially elevated levels of negative affect across time; less pronounced temporal shifts in negative affect were therefore observed before and after binge eating episodes in women high on negative urgency as compared to women low on negative urgency. Effects for purging were relatively similar but less robust: women with lower levels of negative urgency showed significantly greater increases in negative affect prior to purging episodes and a statistical trend towards greater reductions in negative affect following purging episodes (see linear negative urgency \times negative affect interaction terms in Table 3).

4. Discussion

This study was the first to investigate the interplay of negative urgency and negative affect in relation to binge eating and purging behaviors in women with AN. Findings demonstrate that individual differences in negative urgency are associated with differential relationships between negative affect and binge eating and purging, although notably, the pattern of results differed from the initial hypotheses. Individual differences in negative urgency were associated with variability in binge eating frequency on days corresponding to relatively

¹Since ratings of negative affect were centered within-person, relative levels of “low” versus “high” negative affect could differ between subjects. This point is important to highlight since individuals high on negative urgency tended to show higher levels of negative affect across days [b (S.E.) = -5.62 (1.55), Wald $\chi^2=13.23$, $p < .001$: high negative urgency, M (S.E.) = 21.18 (2.31), low negative urgency, M (S.E.) = 15.56 (2.00)] as well higher within-day levels of negative affect before and after binge eating and purging episodes (see Table 3 and Figure 3), as compared to those low on negative urgency. Thus, relatively low levels of daily negative affect in individuals with higher levels of negative urgency could in fact be quite high, and consequently, may at least partially underlie elevated frequencies of binge and purge episodes even on “lower” negative affect days.

lower, rather than higher (as hypothesized), levels of negative affect. Specifically, women with higher negative urgency reported more binge eating episodes than women with low negative urgency on low-to-average negative affect days, yet all women showed heightened binge eating frequency on high negative affect days. In addition, higher levels of negative urgency and elevated negative affect positively predicted purging frequency across days. Within-day analyses corroborated and extended upon the between-day results. Specifically, the relative change in negative affect prior to and following binge eating and purging episodes was significantly greater for women with lower negative urgency (rather than higher negative urgency, as hypothesized). Women with higher negative urgency reported substantially higher negative affect across time, and thus, changes in negative affect levels prior to and following binge eating and purging episodes were less pronounced. Taken together, results indicate that elevated negative urgency and negative affect are linked to increased binge eating and purging behaviors, and importantly, negative urgency may uniquely influence negative affect-binge/purge relationships.

In considering the role of negative urgency in the occurrence of binge eating and purging in AN, our findings suggest that it may be important to consider the intensity and patterns of daily negative affect. A greater propensity to engage in binge eating or purging among individuals high on negative urgency may be driven by a relatively persistent state of heightened affective risk, an effect that has also been observed for other risk behaviors (e.g., alcohol problems).²⁵⁻²⁷ A persistently heightened state of negative affect in women high on negative urgency could explain their less pronounced momentary changes in negative affect prior to and following binge eating and purging, as well as their greater frequency of binge eating and purging across days. That is, women with AN who are high on negative urgency may be more prone to engage in binge eating and purging because 1) they experience intense negative mood states more often than women low on negative urgency, and/or 2) the persistent experience of heightened negative affect places them closer to a negative affect “threshold” for engaging in rash behavior (e.g., binge eating or purging). Nonetheless, it is also important to acknowledge that reinforcement and/or learning effects (e.g., experiencing a reduction in negative affect following binge eating or purging behavior) could also serve to increase the likelihood and frequency of binge eating and purging behavior over time.^{28,29}

Moving forward, it will be important to consider when and how negative urgency increases susceptibility to binge eating and purging episodes in AN, beyond the presence of negative affect. Of note, low distress tolerance (i.e., tendency to experience negative emotions as intolerable), which is more prominent in patients with AN relative to controls,^{30,31} may be one key factor important to explore. Indeed, findings indicate that negative urgency and low distress tolerance interact to increase the likelihood of binge eating and purging behaviors in non-clinical samples, such that women with elevated negative urgency and low distress tolerance have been shown to exhibit the highest levels of bulimic symptoms.³² Future research should aim to directly investigate whether distress tolerance interacts with negative urgency and the experience of negative affect to heighten risk for binge eating and/or purging behaviors in women with AN.

Despite several strengths of this study, particularly the use of ecological momentary assessment methodology to capture changes in affect and behavior in real time, it is not

without limitations. First, it is important to note that the between-day analyses suggest a relationship between negative affect and binge eating and purging behaviors, but these correlational models cannot delineate whether high negative affect days lead to binge eating and purging behaviors or whether elevated negative affect is a consequence of these behaviors. However, our within-day models demonstrated that binge eating and purging behaviors occur after increases in negative affect, providing some evidence of a likely temporal relationship. Second, self-reports of binge eating and purging episodes were used. Despite attempts to provide participants with clear definitions of these constructs, we cannot be certain that all reported binge eating or purging episodes would have been coded as such by clinical raters. Third, this study focused on late adolescent/adult females with AN, many of whom were in treatment; thus, the extent to which our findings extend to other populations (e.g., those with bulimia nervosa or binge eating disorder, adolescents with eating disorders, males with eating disorders, non-treatment seeking) is unknown. Treatment seeking individuals with AN may differ from non-treatment seeking samples in important ways, such as reporting higher levels of negative emotionality and stress.³³ It will therefore be important for future research to determine whether the effects observed in this study extend to diverse samples representing the full eating disorder spectrum and to non-treatment seeking samples. Finally, consistent with the majority of prior research (for exception, see Ref. 22), we examined the broad construct of negative affect. Exploring whether negative urgency moderates the role of more specific negative emotions (e.g., guilt, sadness) and/or negative body-focused affect (e.g., body shame, appearance-anxiety)³⁴⁻³⁵ on binge eating and purging behavior may be beneficial directions for future research.

In summary, the present study extends the literature on binge eating and purging behavior in women with AN. Although the pattern of results differed from the initial hypotheses, these findings significantly contribute to the understanding of relationships between negative urgency, negative affect, and binge eating and purging in AN. Results continue to highlight that negative affect plays a key role in binge eating and purging behavior, and importantly, that individual differences in negative urgency uniquely contribute to the daily experience of negative affect and patterns of eating disorder symptomatology in women with AN.

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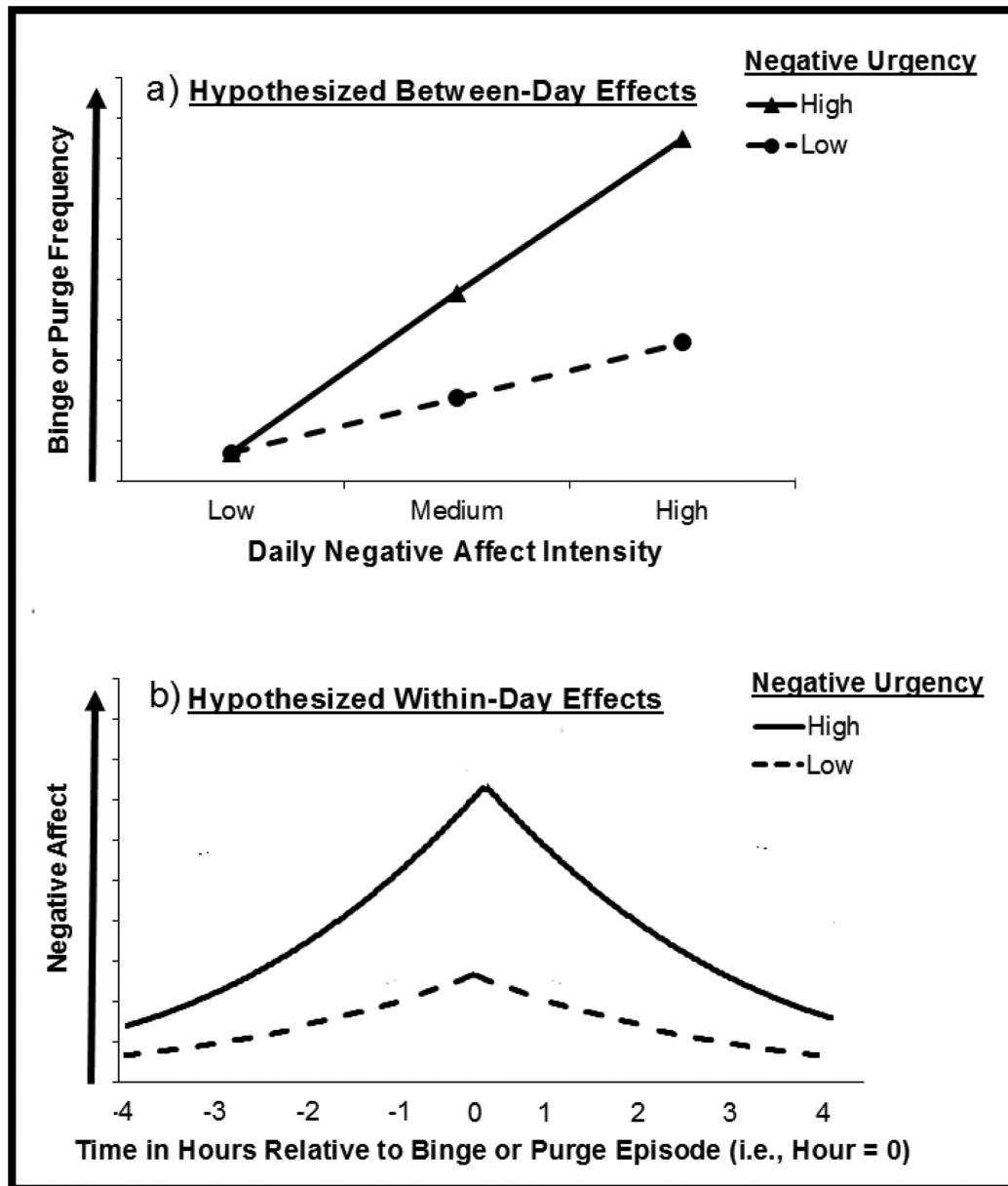


Figure 1.

Hypothesized relationships between negative urgency, negative affect, and binge eating and purging behavior in women with AN: a) women with higher levels of negative urgency will exhibit more binge eating and purging episodes than women with lower levels of negative urgency, particularly on days corresponding to higher levels of negative affect (between-day effects), and b) women with higher levels of negative urgency will show greater temporal changes in negative affect prior to and following binge eating and purging episodes as compared to women with lower levels of negative urgency (within-day effects).

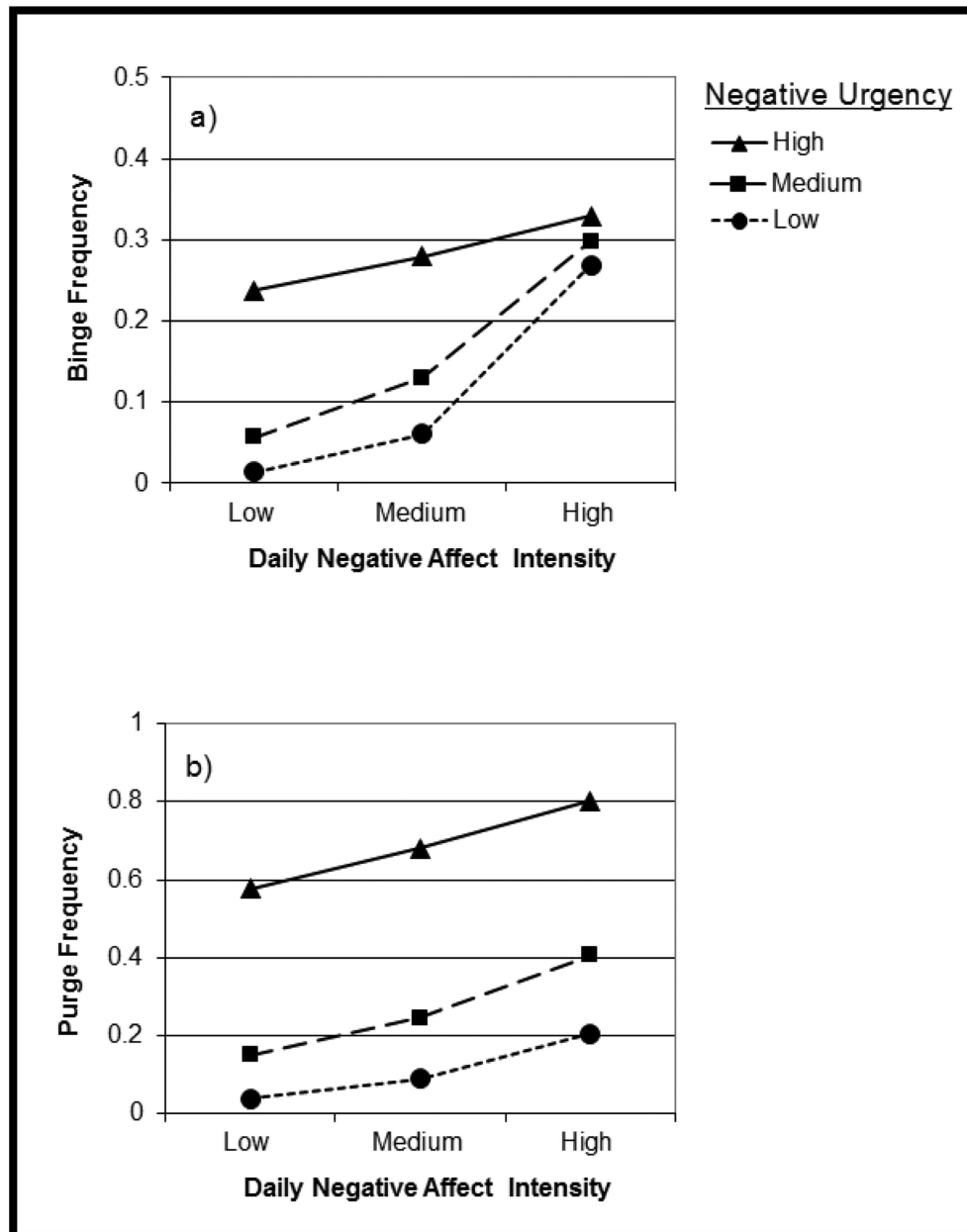


Figure 2. Individual differences in negative urgency and the between-day associations between negative affect and frequency of: a) binge eating or b) purging ($n = 82$). Negative urgency and negative affect were examined as continuous variables and are plotted according to 2 standard deviations above ('high') or below ('low') the mean ('medium') score.

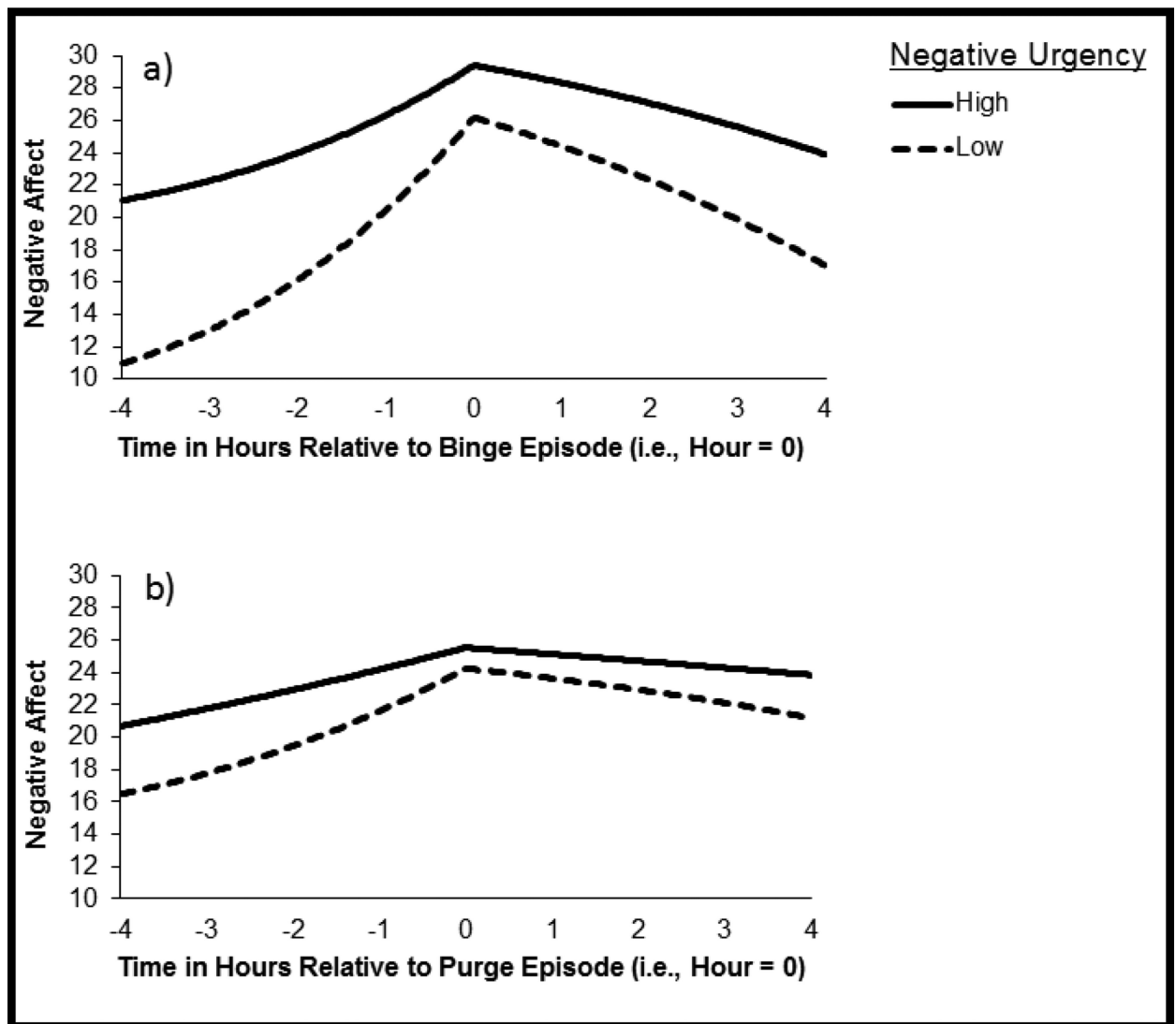


Figure 3. Individual differences in negative urgency and within-day changes in negative affect prior to and following: a) binge eating ($n = 34$), or b) purging ($n = 30$) episodes. Negative urgency was examined as a continuous variable and is plotted according to 2 standard deviations above ('high') or below ('low') the mean score. To ease the visual presentation of results, data are plotted for the 4 hours prior to or following the binge eating or purging episode (i.e., episode occurred at hour = 0); however, all momentary negative affect ratings that occurred on the day of the binge or purge episode were included in statistical analyses, up until the occurrence of a second binge eating or purging episode on the same day.

Table 1

Descriptive Statistics.

	Subsamples: Binge and/or Purge?			Mean Differences	
	Full Sample n = 82	No n = 41	Yes n = 41	With vs. Without Binge or Purge F (df)	Cohen's d
<u>Eating Disorder Symptoms</u>					
<i>Binge Eating Episodes (Per Day)</i>					
Mean (SD)	0.15 (0.44)	--	0.32 (0.60)	--	--
Range	0-4	--	0-4	--	--
<i>Purging Episodes (Per Day)</i>					
Mean (SD)	0.29 (0.74)	--	0.60 (0.99)	--	--
Range	0-7	--	0-7	--	--
<u>Negative Affect</u>					
<i>PANAS Negative Affect</i>					
Mean (SD)	18.37 (8.13)	14.79 (6.11)	21.66 (8.37)	212.96 ^{***}	.82
Range	8-40.00	8-38.17	8-40	(1, 1220)	
<u>Negative Urgency</u>					
<i>UPPS-R Negative Urgency</i>					
Mean (SD)	2.47 (0.63)	2.27 (0.51)	2.67 (0.68)	130.72 ^{***}	.64
Range	1.25-3.83	1.33-3.75	1.25-3.83	(1, 1220)	

Note: PANAS = Positive and Negative Affect Schedule; UPPS-R = UPPS Impulsive Behavior Scale-Revised; Participants "without binge or purge" = no reported episodes of binge eating or purging during the duration of the EMA ratings. Participants "with binge and/or purge" = reported at least one episode of binge eating and/or purging during the duration of the EMA ratings (binge eating only, n = 11, purging only, n = 7, both binge eating and purging, n = 23).

p < .001

Table 2

Between-Day GEE Models for Binge Eating and Purging Frequency.

Variables	b (SE)	Wald χ^2	p
<u>Binge Eating Frequency</u>			
Intercept	-2.05 (0.23)	80.45	<.001
Negative Affect	0.13 (0.02)	35.12	<.001
Negative Urgency	0.61 (0.37)	2.74	.10
Negative Affect \times Negative Urgency	-0.08 (0.03)	8.28	.004
<u>Covariate Effects</u>			
Study Day	-0.03 (0.02)	2.55	.11
Study Day \times Negative Affect	0.004 (0.004)	0.77	.38
Study Day \times Negative Urgency	0.02 (0.04)	0.28	.60
<u>Purging Frequency</u>			
Intercept	-1.40 (0.26)	28.80	<.001
Negative Affect	0.08 (0.03)	14.69	<.001
Negative Urgency	0.80 (0.42)	3.63	.06
Negative Affect \times Negative Urgency	-0.04 (0.02)	4.09	.04
<u>Covariate Effects</u>			
Study Day	-0.02 (0.01)	10.74	.001
Study Day \times Negative Affect	0.004 (0.005)	0.70	.40
Study Day \times Negative Urgency	-0.02 (0.01)	2.13	.14

Note: "Study Day" was modeled via main and interaction effects to ensure that the Negative Affect \times Negative Urgency interaction term was properly adjusted for by the potentially confounding effects of this covariate. Degrees of freedom for Wald $\chi^2 = 1$.

Table 3

Within-Day Multilevel Models for Binge Eating and Purging Episodes.

Variables	Binge Eating			Purging		
	b (SE)	<i>t</i>	<i>p</i>	b (SE)	<i>t</i>	<i>p</i>
Intercept	26.19 (1.26)	20.75	<.001	24.25 (1.34)	18.08	<.001
Negative Urgency	3.24 (1.80)	1.80	.08	1.28 (2.13)	0.60	.55
Hours prior to Episode	2.41 (0.25)	9.72	<.001	1.19 (0.22)	5.37	<.001
(Hours prior to Episode) ²	0.32 (0.05)	6.45	<.001	0.12 (0.05)	2.67	.008
(Hours prior to Episode) ³	0.01 (0.002)	4.98	<.0010	.004 (0.002)	1.79	.07
Hours prior to Episode × Negative Urgency	-1.16 (0.32)	-3.59	<.001	-0.69 (0.31)	-2.20	.03
(Hours prior to Episode) ² × Negative Urgency	-0.14 (0.06)	-2.24	.03	-0.10 (0.06)	-1.61	.11
(Hours prior to Episode) ³ × Negative Urgency	-0.004 (0.003)	-1.23	.22	-0.004 (0.003)	-1.32	.19
Hours following Episode	-2.72 (0.27)	-10.03	<.001	-1.28 (0.23)	-5.65	<.001
(Hours following Episode) ²	-0.31 (0.05)	-6.39	<.001	-0.12 (0.05)	-2.65	.008
(Hours following Episode) ³	-0.01 (0.002)	-4.99	<.001	-0.004 (0.002)	-1.79	.07
Hours following Episode × Negative Urgency	1.21 (0.36)	4.29	.001	0.63 (0.32)	1.94	.05
(Hours following Episode) ² × Negative Urgency	0.14 (0.06)	2.64	.03	0.10 (0.06)	1.62	.11
(Hours following Episode) ³ × Negative Urgency	0.004 (0.003)	1.23	.22	0.004 (0.003)	1.32	.19

Note: Episode = refers to binge eating or purging episode. Intercept = estimated value of negative affect at the time of the binge or purge event when negative urgency is 0 (i.e., the mean). Negative Urgency = estimated increase (or decrease) in the intercept for each one unit increase in negative urgency. Linear functions = rate of change in negative affect prior to and following binge eating or purging; Quadratic functions = acceleration in rate of change in negative affect prior to and following binge eating or purging; Cubic functions = further acceleration or dampening of the acceleration in rate of change in negative affect prior to and following binge eating or purging.