Perseverative thinking in eating pathology: do rumination patterns differ according to symptom type?

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PERSEVERATIVE THINKING IN EATING PATHOLOGY:
DO RUMINATION PATTERNS DIFFER
ACCORDING TO SYMPTOM TYPE?

by

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Abstract

Rumination, defined as repetitive, negative, self-referential thinking, is strongly associated with the development and maintenance of many internalizing disorders. Although rumination was first examined within the depression literature, it is now considered a trans-diagnostic risk factor that underlies many psychological disorders. Despite the negative consequences of engaging in these thought processes, rumination is a common cognitive process, perhaps due to positive metacognitive beliefs about the function of rumination. Recent work has demonstrated a link between eating pathology and a tendency to ruminate on eating disorder-relevant themes, as well as beliefs about the usefulness of rumination. Our understanding of this relationship is limited, however. Thus, the current study seeks to examine the relationship between disordered eating symptoms and rumination. Undergraduates ($N = 481, 53.9\%$ female) completed questionnaires related to disordered eating, rumination, and beliefs about rumination. Analysis of variance revealed differences between those endorsing symptoms and those endorsing no symptoms in all rumination variables. Results of discriminant analyses indicated that eating disorder-related brooding and reflection significantly classify groups according to disordered eating symptoms.
Perseverative thinking in eating pathology:

Do rumination patterns differ according to symptom type?

A cognitive approach to psychopathology posits that specific psychological disorders are characterized by disorder-specific, maladaptive cognitive profiles (Beck, 1976). Repetitive, negative thought processes have been found to be present across multiple psychological states and disorders (i.e., Watkins, 2008). This is a core feature of cognitive rumination, defined as repetitive, passive focus on negative emotions, events, and symptoms, as well as their causes, meanings, and consequences (Nolen-Hoeksema, 1991).

**Review of Rumination**

Rumination was first examined as a specific “response style” (Response Styles Theory, Nolen-Hoeksema, 1991) or a stable, enduring, trait-like pattern of responses performed to regulate emotion. Findings suggest highly ruminative individuals tend to respond to their negative emotions with repetitive self-focus (Nolen-Hoeksema, 1991). Research in Response Styles Theory has found that individuals who engage in more ruminative responses tend to have higher levels of depressive symptoms and experience more distress and elevated depression after experiencing loss, such as the death of a loved one (Nolen-Hoeksema & Davis, 1999; Nolen-Hoeksema & Morrow, 1991).

To date, empirical study of the Response Styles Theory (RST) has demonstrated largely negative consequences of engaging in depressive rumination. The RST postulates that rumination predicts, maintains, and intensifies negative mood states through continuous activation of negative association memory networks in the brain, interfering with attention, impairing problem solving, and hindering social support (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Moreover, rumination has been shown in laboratory manipulations to
prolong or exacerbate negative mood and impaired cognitive processes (e.g., Keuhner, Huffziger, & Liebsch, 2009; Lyubomisrky, Kasri, & Zehm, 2013).

An alternative view of rumination is the Control Theory account, which posits that state episodes of ruminative thought are triggered by and focus on a perceived discrepancy between one’s goals and one’s current state, and persists until the goal is met or abandoned (Martin & Tesser, 1989, 1996). According to this account, rumination is a conscious process that can serve an instrumental function (i.e., goal fulfillment). Thus, prolonged and repetitive thinking about one’s self, behavior, and emotions can potentially be constructive or normative, particularly when it assists in the attainment of concrete and realistic goals (Altamirano, Miyake, & Whitmer, 2010; Watkins, 2008). However, in cases of unconstructive rumination, the process can become exaggerated and detrimental – such as when goals are unattainable, or ruminated upon in excessively negative, abstract, or evaluative manners (Watkins & Nolen-Hoeksema, 2014). Indeed, Watkins and Moulds (2005) found that rumination inhibited problem solving through “reduced concreteness,” such that when negative self-focus is more abstract, rumination has more adverse effects.

Accordingly, rumination is hypothesized to affect mood, not through an overall increase in the frequency of negative thoughts, but by enhancing the effects of existing negative thoughts or schemata (Morrow & Nolen-Hoeksema, 1990). Thus, an interactive model of rumination has been developed in which individuals who engage in more frequent rumination are at heightened risk for depression only if they also demonstrate higher levels of negative cognitions (Ciesla & Roberts, 2007). A study of undergraduates with elevated depression found that endorsing both a tendency to ruminate and maladaptive cognitive content made individuals markedly more vulnerable to the effects of stressors (Ciesla, Felton, & Roberts, 2011).
Thus, it appears that engaging in rumination is not inherently risky, but rumination on content that is abstract and negative increases the risk of adverse effects. Despite evidence to suggest rumination can have constructive and unconstructive features, the most widely-used rumination scale, (Ruminative Response Scale (RRS); Nolen-Hoeksema & Morrow, 1991) was developed as a single-factor scale, arguably failing to capture the nuance of the construct. Therefore, a later factor analysis of the scale identified two subtypes of depressive rumination: Brooding and Reflective Pondering (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Brooding refers to the tendency to dwell on the negative consequences of one’s depressed mood, whereas reflection involves attempts to understand the reasons for one’s depressed mood.

Although brooding and reflection are each related to depression, the link between brooding and depressive symptoms is stronger (Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Treynor et al., 2003). Raes and Hermans (2008) found that brooding, rather than reflection, mediated the relationship between childhood emotional abuse and depressive symptoms. These findings are consistent with the interactive model of rumination and may be attributable to the nature of brooding, which, unlike reflection, entails highly negative, self-critical, evaluative, judgmental, and comparative thoughts about the self (e.g., “Why do I have problems other people don’t have?”; Nolen-Hoeksema & Morrow, 1991). Reflection, on the other hand, generally involves neutral pondering about more concrete themes (Treynor et al., 2003).

**Rumination as a Risk Factor**

Although the study of rumination originated in the depression literature, rumination is now considered a transdiagnostic construct that underlies multiple psychological disorders (Nolen-Hoeksema & Watkins, 2011). The majority of research on rumination has focused
specifically on its role in various internalizing disorders. Longitudinal studies indicate that people who engage in more ruminative responses have higher levels of depressive symptoms over time, even when controlling for baseline levels of depression (Nolen-Hoeksema & Davis, 1999; Nolen-Hoeksema, Larson, & Grayson, 1999; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Morrow, & Frederickson, 1993; Nolen-Hoeksema, 2000). The proposed mechanism of this relationship is prolonged, intensified negative affect brought on by rumination (e.g., Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, 2000).

Moreover, inducing rumination in depressed patients has been shown to interfere significantly with problem-solving, indicating that people who tend to ruminate may be less likely to develop effective coping skills and problem-solving strategies, thus exacerbating their distress (Donaldson & Lam, 2004; Nolen-Hoeksema et al., 1993). Rumination has been found to mediate the relationship between depression and anxiety, such that baseline depression scores predicted elevated anxiety scores, mediated by an increase in rumination (McLaughlin & Nolen-Hoeksema, 2011).

Rumination also appears to be involved in externalizing behaviors such as alcohol and substance abuse (e.g., Caselli et al., 2010; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). In conjunction with “Escape Theory” (Heatherton & Baumeister, 1991), research suggests that frequent negative rumination may lead to heightened aversive self-awareness that motivates behaviors (e.g., substance abuse) that serve to provide relief from the aversive state. Some models of aggression posit that rumination following a provocation may heighten anger and lead to increases in aggressive behavior (Bettencourt, Talley, Benjamin, & Valentine, 2006; Vasquez et al., 2013).
Thus, according to Nolen-Hoeksema and Watkins (2011), a tendency to ruminate can be conceptualized as a transdiagnostic risk factor, or a factor underlying numerous symptom patterns, depending on the presence of specific moderating factors. Although our knowledge of rumination and its role in various disorders is expanding, there is a paucity of research on how rumination relates to eating disorders.

**Eating Disorders**

Eating pathology encompasses a set of psychiatric problems that are associated with serious medical and psychological consequences, representing a serious public health concern. Eating disorders, including threshold and subthreshold anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED), are among the most prevalent psychiatric problems. Lifetime prevalence estimates of DSM-IV diagnoses of these disorders shows that they affect between .3% to 3% of the population, with higher estimates in female samples (Hoek & van Hoeken, 2003; Hudson, Hiripi, Pope, & Kessler, 2007). Eating disorders are associated with impairment and distress (Hudson et al., 2007), increased risk of death, particularly by suicide (Hoek, 2006), and are often characterized by chronicity and relapse (Fairburn, Cooper, Doll, Norman, & O’Connor, 2000). As such, it is important to identify vulnerability factors that predispose certain individuals to these disorders.

**The Cognitive Model of Disordered Eating**

Cognitive theories have been developed to account for the etiology of various forms of disordered eating, and are based largely on Beck’s cognitive model of emotional disorders (Beck, 1976). All eating disordered groups (full and subthreshold syndromes) are characterized by distorted, primarily negative thoughts about eating, weight, or shape and ability to control these (Fairburn, Cooper, & Shafran, 2003). Simply stated, in AN, rigid and distorted thoughts...
about the importance of thinness often contribute to restrictive eating behaviors and weight loss; the weight loss is socially reinforced and strengthens the initial distorted beliefs, thus perpetuating the cycle (Cooper, Todd, & Wells, 2009; Garner & Bemis, 1982).

In BN, positive, permissive thoughts about the usefulness of eating (e.g., eating relieves negative thoughts, affect) in addition to negative, distorted thoughts about weight and control, lead to the combination of binge eating episodes and compensatory behaviors (Cooper, Wells, & Todd, 2004). The majority of cognitive theories of disordered eating center on the content, rigidity, and distorted nature of the cognitions. To date, little work has been done to include the style or process of cognition into these theories (e.g., perseverate, ruminative thinking). However, there is accumulating evidence to suggest that repetitive thinking styles such as rumination may be an important aspect of the cognitive profile of individuals with eating disorders.

**The Role of Rumination in Disordered Eating**

Rumination was first empirically linked to disordered eating by Nolen-Hoeksema, Stice, Wade, & Bohon (2007), who studied the relations between rumination and bulimic behavior, substance abuse, and depressive symptoms in female adolescents. Although research on the role of rumination in eating disorders is still limited, the evidence generally supports a link between rumination (particularly brooding) and all variations of eating pathology.

In AN, analytical over-focus on eating, weight, and shape is common and resembles rumination (Park, 2011). Anorexia is associated with rigid, ruminative, cognitive and behavioral routines (e.g., counting calories, body checking, over-exercise). A quasi-experiment conducted by Cowdrey, Stewart, Roberts, and Park (2013) found that engaging in distraction or mindful breathing exercises prior to meal times was ineffective in reducing rumination in patients with
AN. The authors suggested that these findings may be due to AN patients’ excessive tendency to ruminate, particularly when confronted with an emotionally-salient trigger such as food (Cowdrey et al., 2013). Rawal, Park, and Williams (2010) examined rumination within a clinical sample of individuals diagnosed with AN and found that these patients differed significantly from healthy controls in their tendency to ruminate, and to brood, specifically.

Rumination has also been linked to BN and BED. Nolen-Hoeksema and colleagues (2007) found that heightened levels of ruminative coping predicted increased levels of bulimic symptoms one year later in adolescent girls. They explained these findings in accordance with Escape Theory (Heatherton & Baumeister, 1991), which posits that individuals who fail to meet a personal standard or goal may experience a state of “aversive self-awareness” about their perceived shortcomings. According to Nolen-Hoeksema and colleagues (2007), rumination is the cognitive process that contributes to this negative mood state. Binge eating and other bulimic symptoms may be motivated by an effort to escape from the negative mood elicited by rumination (Nolen-Hoeksema et al., 2007), alleviating these negative thoughts and emotions through a focus on the physical sensations of eating (Heatherton & Baumeister, 1991).

The finding that rumination is related to development of bulimic symptoms is also compatible with the Emotional Cascade Model (Selby, Anestis, & Joiner, 2008), which identified rumination as a key contributing factor in the emotion dysregulation that precedes many maladaptive coping behaviors, including binge eating and bulimic behaviors. According to this model, rumination in response to a stressor or negative life event leads to a cascade of negative emotions that worsens and becomes unbearable to the individual, who feels an urgency to act in order to alleviate the distress (Selby et al., 2008; Selby, Anestis, Bender, & Joiner, 2009).
Empirical evidence supports this model by showing reports of increased negative affect prior to the onset of a binge episode (e.g., Lingswiler, Crowther, & Stephens, 1989; Smyth et al., 2007; Telch & Agras, 1995) and reduced negative affect following a binge episode (Kaye et al., 1986). Conversely, other studies have found that negative mood may continue to increase after a binge episode (Hilbert & Teschen-Caffer, 2007), only decreasing after compensatory behaviors are used (Smyth et al., 2007). Further, bulimic patients have been found to report greater stress, preoccupation with food, and negative affect than binge eaters prior to a binge episode (Lingswiler, Crowther, & Stephens, 1989). Although the research generally shows consistent findings regarding affect, binge eating, and compensatory behaviors, there appear to be some differences based upon symptom pattern. Therefore, because rumination is linked with affective state and contributes to elevated negative affect prior to behavioral dysregulation (e.g., self harm, substance abuse, and binge eating), there may be differential patterns of rumination in individuals endorsing different patterns of bulimic symptoms.

Content of Rumination in Eating Disorders

The content focus of rumination may differ according to specific diagnosis and may serve as a moderator that brings about a particular diagnosis. Based on the cognitive theory of psychopathology and specifically the Content-Specificity Hypothesis (Beck et al., 1987), patients with different diagnoses tend to exhibit differences in the content of their negative or distorted cognitions. In depression, rumination has been found to involve negative, self-referential themes, such as negative appraisals of self, feelings of loss, and failure to achieve important goals (Wells & Matthews, 1994). In anxiety, perseverative thoughts are often referred to as worry, and the content of these thoughts revolves around themes of negative future events (Beck et al., 1987).
Research on the content of rumination in other diagnostic categories is scarcer, including in the field of eating disorders.

Informal observations from clinicians treating individuals with eating disorders demonstrate that the content of their patients’ rumination is largely disorder-specific, commonly involving negative thoughts about themes such as their inability to control food intake and dissatisfaction with their body weight or shape (Cooper, Todd, & Wells, 2009). Cowdrey and Park (2011) developed the Ruminative Response Scale – Eating Disorders, a modified version of the Ruminative Response Scale (Nolen-Hoeksema, 1991). This scale assesses eating disorder-related rumination, which the authors found to be distinct from depressive rumination (Cowdrey & Park, 2011).

Experimental evidence suggests that rumination on specific, eating-disorder related negative thoughts may heighten anxiety and state body image dissatisfaction. Etu and Gray (2010) instructed undergraduate women to read a negative body image related scenario and subsequently either ruminate on the scenario or use a positive distraction. Participants in the rumination condition reported significantly higher body image distress and anxiety following the task than did those in the distraction condition (Etu & Gray, 2010). Therefore, individuals who tend to ruminate more on negative feelings about their body shape and weight may, in turn, increase their body dissatisfaction, which is a prominent risk factor for eating disorders (Stice, 2002). Furthermore, a mixed qualitative and quantitative investigation found that inducing rumination in patients with AN prior to mealtimes increased analytical self-focus, heightened negative affect, and interfered with ability to eat (Cowdrey, Stewart, Roberts, & Park, 2013).

Further empirical evidence has supported informal, clinical observations that rumination on disorder-specific themes is common in individuals seeking treatment eating disorders.
Gordon, Holm-Denoma, Troop-Gordon, and Sand (2012) found that tendency to engage in brooding rumination interacted with levels of body dissatisfaction to predict concurrent binge eating in undergraduate students. They concluded that in individuals high in body dissatisfaction, the content of rumination may commonly be negative body weight and shape-related thoughts. This is consistent with the Control Theory account of rumination (Martin & Tesser, 1989), which suggests that individuals ruminate about life domains in which they feel discrepant. Elevated levels of body dissatisfaction imply a perceived discrepancy between current and ideal body weight and shape. Therefore, consistent with Escape Theory and Emotional Cascades Theory, patients with BN and BED may exhibit a greater tendency to ruminate about disorder-specific themes, leading to heightened negative affect that triggers the disordered eating behaviors.

**Metacognitive Beliefs about Rumination**

Taking into consideration the evidence supporting the numerous negative consequences of rumination, it is important to gain an understanding of why individuals engage in such unhelpful cognitive processes. Therefore, research has examined the reasons why rumination may be used as a response style or coping strategy. Some researchers have posited that metacognitive beliefs about the functions and consequences of rumination may influence individuals’ tendencies to engage in rumination (Wells & Matthews, 1994). For example, Papageorgiou and Wells (2001) found that patients with recurrent major depressive episodes endorsed more positive beliefs about rumination, including that it serves as a coping strategy. Furthermore, they found that these positive beliefs about rumination prospectively predicted increases in rumination over time, which predicted increased depressive symptoms (Papageorgiou & Wells, 2001).
Possessing positive metacognitive beliefs about the function of rumination is linked to a greater tendency to ruminate, which can worsen psychological symptoms. Lyubomirsky and Nolen-Hoeksema (1993) found that more dysphoric individuals who ruminated reported a reduced willingness to engage in pleasant distraction, due to fear that it would impede their efforts to understand and gain insight into their problems.

Little is known about how disordered eating relates to beliefs about the function and consequences of rumination. Metacognitive theories of disordered eating suggest that individuals with eating pathology likely hold both positive and negative metacognitive beliefs about rumination and other forms of repetitive thought (Cooper, Todd, & Wells, 2009). In accordance with the Control Theory account (Martin & Tesser, 1989), rumination may be triggered when disordered eating patients feel discrepant in their weight and shape, or their ability to control and restrict their eating. In such cases, rumination may be perceived as a means of goal attainment.

Indeed, individuals with eating pathology may perceive rumination as a useful strategy for maintaining control and focus on goals. Rawal and colleagues (2010) examined ruminative tendencies and positive beliefs about rumination within a sample of 117 healthy undergraduates. They found that higher levels of rumination predicted higher levels of eating pathology, as measured by the EDE-Q composite score. The authors theorized that patients with AN report a need for control and predictability (Fairburn et al., 1998), which may encourage these positive metacognitive beliefs that rumination helps them to rigidly maintain control. To date, no known empirical study exists of the relationship between bulimic symptoms and metacognitive beliefs about rumination.

**Present Study**
Although there is a growing body of evidence to support the link between rumination and various forms of disordered eating, there has not yet been an examination of how tendency to ruminate differs between individuals with different symptom patterns. Furthermore, our understanding of the link between positive beliefs about rumination within eating disorders is limited. The current study seeks to replicate and expand upon prior work on the role of rumination in eating disorders. We approach these aims using a transdiagnostic perspective, examining individuals who report a variety of eating disorder symptoms compared to those who endorse none. Using a more nuanced approach, we aim to examine specific symptom patterns and how they relate to features of rumination.

Specifically, we aim to replicate existing research by examining whether participants endorsing bulimic symptoms differ from those endorsing no bulimic symptoms in their overall tendency to ruminate and their positive beliefs about rumination. Additionally, we seek to explore how general rumination, brooding and reflection on eating disorder-relevant themes, and positive beliefs about rumination distinguish between groups exhibiting different bulimic symptoms (i.e., individuals who binge without compensatory behaviors, those who engage in compensatory behaviors in the absence of binge eating, and those who both binge and use compensatory behaviors). Finally, we seek to identify which predictor variables are the most important variable in distinguishing between symptom groups.

In line with prior research, we predicted that rumination tendencies and positive beliefs about rumination would differ between participants who endorsed any bulimic symptoms and those who did not, with symptomatic individuals exhibiting higher levels of rumination and more positive beliefs. Within the discriminant analyses, our aims are exploratory in nature, however we expect that eating disorder-related brooding and general rumination tendency (i.e., ruminative
response style with depressive themes) will be the most important discriminating variables distinguishing between symptom groups.

**Methods**

**Participants**

The current study was approved by the university’s Institutional Review Board. Participants were undergraduates (N = 481) at a public university in the Northeast United States. Participants were recruited from psychology courses and provided informed consent prior to participation. As compensation, all participants were granted class credit for completing the study. The sample ranged in age from 17 to 44 (M = 18.91; SD = 2.31) and participants were predominantly female (53.9%). Participants most commonly self-identified as Caucasian (47.6%) and remaining participants identified as African American (17.7%), Hispanic (11.7%), Asian/Pacific Islander (22.1%), Native American (0.9%), or “Other” (0.9%).

**Measures**

Participants were asked to provide demographic information, including gender, age, height, weight, and ethnicity. Self-reported height and weight were used to calculate participants’ body mass indices (BMI).

**Tendency to Ruminate.** The Ruminative Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991) is a 22-item self-report scale that was developed to assess tendency to engage in depressive rumination in response to depressed mood. Factor analysis has revealed two subscales within the overall scale (Brooding and Reflection; Treynor et al., 2003). Both subscales were used in the present study. Participants are instructed to respond based on how often they would react in certain ways to depressed mood (e.g., “Think about how alone you feel.”). Responses
range from “almost never” (1) to “almost always” (4). In our sample, the scale showed a Cronbach $\alpha$ of .90.

**Eating Disorder-Related Rumination.** The Ruminative Response Scale – Eating Disorders (RRS-ED; Cowdrey & Park, 2011) was developed from a subset of the original RRS (Nolen-Hoeksema & Morrow, 1991; Treynor, Gonzalez, & Nolen-Hoeksema, 2003) and measures individuals’ tendency to engage in cognitive rumination specifically related to their eating. The scale consists of nine items and contains two subscales – Reflection and Brooding on eating-related topics – and a Composite score. The present study used both the Reflection and Brooding subscales. Participants are instructed to indicate what they would typically do when they face concerns about eating, weight, and shape (e.g., “Think, ‘why do I have such issues with my eating, weight and/or shape?’”). Responses range from “almost never” (1) to “almost always” (4). The scale has shown moderate to high internal consistency (Brooding $\alpha = .89$; Reflection $\alpha = .64$; Cowdrey & Park, 2011). In our sample, the subscales showed Cronbach $\alpha$ ranging from .80 to .90 and the overall scale showed a Cronbach $\alpha$ of .90.

**Eating Disorder Symptoms.** The Eating Disorders Examination – Questionnaire (EDE-Q; Fairburn & Beglin, 1994) was developed to measure disordered eating attitudes and symptoms over the previous 28 days. The measure consists of four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) and a Global score. The measure also provides information about the presence and frequencies of disordered eating behaviors, including binge eating and various compensatory behaviors (e.g., vomiting, laxative use, over-exercise). The present study used single items that assessed the presence and frequency of clinical levels of binge eating (i.e., eating large amounts of food in a discrete period of time, loss of control over eating, and distress) and compensatory behaviors.
Positive Beliefs about Rumination. The Positive Beliefs about Rumination Scale (PBARS; Papageorgiou & Wells, 2001) was developed to measure individuals’ positive beliefs about engaging in depressive rumination. The scale consists of nine items (e.g., “I need to ruminate about my problems to find the answers to my depression.”). Participants are instructed to respond to each item according to how much they agree with each item, on a scale ranging from “do not agree” (1) to “agree very much” (4). Higher scores indicate a higher degree of positive beliefs about rumination. The scale has shown good internal validity and reliability, Cronbach α = .89; test-retest Pearson product moment coefficient, r(58) = .85 (Papageorgiou & Wells, 2001). In the present sample, the scale showed a Cronbach α of .94.

Procedure

Each participant attended one in-lab appointment where they indicated their informed consent to participate in the study and completed measures (described above) online using a lab computer. Each in-lab session lasted approximately 30 minutes, but participants were allowed up to one hour to complete the measures.

Analytic Plan

Of the original 481 cases, 12 were removed from the analyses due to missing data. Missing data appeared to be randomly dispersed throughout groups and predictors. Based on responses to the EDE-Q, participants were divided into groups according to presence of eating disorder symptoms. Participants who endorsed binge eating with no compensatory behaviors were categorized as “Binge-Only” those who endorsed both binge eating and compensatory behaviors (e.g., purging) were categorized as “Binge and Purge,” and those who endorsed only the use of compensatory behaviors without presence of binge eating were categorized as “Purge-Only.” A random sample of 155 was taken from the participants who endorsed none of the
previously listed symptoms. This was performed because the first step of the analyses used
ANOVA, an analysis that is sensitive to differences in group size. The remaining cases were
removed from the analyses.

Data were analyzed using the Statistical Package for the Social Sciences Version 20
(SPSS). First, to assess whether participants who endorsed disordered eating differed in their
overall tendency to ruminate and positive beliefs about rumination from participants who
endorsed no disordered eating, a set of analyses of variance (ANOVA) was conducted.
Following the ANOVA, a discriminant analysis was performed in order to determine whether the
predictor variables could adequately predict group classification. Discriminant analysis was
chosen due to its strength in predicting classification into naturally-occurring groups based on a
set of dependent variables, rather than drawing inferences about mean differences on dependent
variables between assigned groups (Tabachnik & Fidell, 2013). This analysis is the inverse – but
mathematical equivalent – of a one-way multivariate analysis of variance (MANOVA), such that
the levels of the independent variable in MANOVA become the categories of the dependent
variable in discriminant analysis, and the dependent variables in MANOVA become the
independent variables or predictors. Discriminant analysis can be used to predict group
membership based on a set of predictor variables and step-wise discriminant analyses selects the
predictors that minimize the Wilks Lambda, keeping only most important variables in the
classification procedure.

**Results**

**Descriptive Statistics**

A total of 154 (32.84%) of the sample endorsed binge eating and/or use of compensatory
behaviors. Of the participants who endorsed disordered eating, 23 (14.94%) reported use of
compensatory behaviors in the absence of binge eating, 16 (10.39%) reported both binge eating and compensatory behaviors, and 115 (74.68%) endorsed binge eating without compensatory behaviors. A total of 107 of the disordered eating group were female (69.48%) and 71 were Caucasian (46.10%). Of note, Asians were the most frequent endorsers of compensatory behaviors in the absence of binge eating, or both binge eating and purging.

**Preliminary Analyses**

Prior to analysis, each variable was examined to determine if the assumptions of the analyses were met. The normality distributions for each variable within each symptom group were examined. All variables appeared to be normally distributed and met the required cut-off values of 3.0 for skewness and 8.0 for kurtosis. There were no univariate or multivariate outliers (i.e., more than two standard deviations above the mean). Bivariate scatterplots were examined for all predictor variables and revealed no evidence of non-linear relationships between variables. Finally, the virtual inflation factors (VIF) were within acceptable ranges (all less than 3.0), indicating absence of multicollinearity and singularity. Statistically significant heterogeneity of variance-covariance was found in the present sample ($F(12, 8632)=1.96, p = .024$). Therefore, classification on the basis of separate covariance matrices was performed in the discriminant analysis (Tabachnik & Fidell, 2013).

First, a set of three ANOVA was performed in which presence of self-reported eating disorder symptoms (Symptoms vs. No Symptoms) was the independent variable and general brooding and reflection and positive beliefs about rumination were the dependent variables. Bonferonni adjustments ($\alpha = .05$) were made to control for multiple tests. As predicted, the ANOVA showed a significant effect for disordered eating status for all three dependent
Next, to determine the linear combination of variables that optimally differentiated between the three groups (Binge-Only, Purge-Only, and Binge-Purge), a step-wise discriminant analysis was performed. Predictors were ED-Brooding, ED-Reflection, general rumination tendency, and PBARS. At each step of the discriminant analysis, the variable that minimizes the overall Wilks’ Lambda is entered; ED-Brooding was entered in the first step and ED-Reflection was entered at the second step. Subsequent variables were not entered, as they did not meet the significance level of the $F$ statistic required to be included in the analysis ($p = .10$). Therefore, contrary to our prediction, PBARS and general tendency to ruminate do not distinguish between the symptom groups. Indeed, tests of equality of group means showed non-significant differences between groups in general rumination tendency, $F(2, 141) = 1.29, p = .28$, and PBARS, $F(2, 141) = .41, p = .66$. Therefore, further analyses do not include general rumination and PBARS.

Two discriminant functions were calculated with a combined $F(4, 280) = 3.94; (p = .004)$. After removal of the first function, there was still a strong association between groups and predictors: $F(2, 141) = 3.89, p = .02$. The canonical $R^2 = .07$ for the first discriminant function and .03 for the second discriminant function. Thus, the two functions accounted for about 7% and 5% of the total relationship between predictors and between groups. The two discriminant functions account for 70.2% and 29.8% of the discriminating ability, respectively (see Table 1, Appendix).

The first discriminant function maximally separates the Purge-Only group from the other two groups, whereas the second discriminant function maximally separates Binge-Purge group from the other two groups (see Figure 1). The structure matrix of correlations between predictors
and discriminant functions (see Table 2, Appendix) suggests that ED-Brooding best distinguishes between the Purge-Only group and the other groups and that both ED-Brooding and ED-Reflecting distinguish between the Binge-Purge group and the other groups. Individuals in the Purge-Only group have a lesser tendency to brood on eating disorder symptoms (mean = 2.14, SD = .54) than Binge-Only (mean = 2.50 SD = .88) and Binge-Purge (mean = 2.90, SD = .69). Individuals in the Binge-Purge group exhibit higher levels of ED-Brooding than the other two groups, as well as higher levels of ED-Reflection (mean = 2.07, SD = .79) than the Purge-only (mean = 1.64, SD =.73) and Binge-only (mean = 1.64, SD = .73) groups.

Discussion

The aim of the present study was to strengthen the existing evidence that suggests a link between rumination and disordered eating, as well as to extend upon that evidence by providing a more nuanced understanding of how rumination may differ according to symptom pattern. Consistent with our predictions, individuals who endorsed bulimic symptoms (i.e., binge eating and/or compensatory behaviors) also demonstrated higher levels of general rumination, both brooding and reflection, and more positive beliefs about rumination. Furthermore, tendency to brood and reflect on eating disorder symptoms distinguished between specific disordered eating symptom groups. Contrary to our hypothesis, PBARS and general rumination tendency did not distinguish between eating disorder symptom groups.

In line with previous findings, individuals who self-reported the presence of disordered eating symptoms also reported more frequent general rumination, measured by the RRS, and more positive beliefs about rumination. This supports previous empirical and theoretical work (Cowdrey & Park, 2011; Cowdrey, Stewart, Roberts, & Park, 2013; Nolen-Hoeksema et al., 2007) that puts forth rumination as an important contributing factor in disordered eating.
symptoms. Applied more specifically to symptoms of BN, our findings support theories (Heatherton & Baumeister, 1991; Selby et al., 2008) that explain bulimic symptoms such as binge eating as a means of escaping from or alleviating intense negative emotions brought on by rumination.

Our findings that both brooding and reflection on disordered eating themes distinguished between symptom groups suggests that ED-rumination may play a different role in the manifestation of different symptoms. According to our discriminant analysis, individuals who endorsed the use of compensatory behaviors with no binge eating showed an overall lesser tendency to brood on disordered eating symptoms. This finding supports prior work that has specified binge eating as a common method of coping with negative affect (e.g., Heatherton & Baumeister, 1991). Compensatory behaviors have been found to serve emotion regulation functions (Berg et al., 2014; Haedt-Matt & Keel, 2015; Wedig & Nock, 2010), but are more commonly associated with regulating the guilt and anxiety that accompanies a binge episode.

Individuals who endorsed both binge eating and compensatory behaviors demonstrated higher levels of both brooding and reflection. This finding suggests that the presence of both symptoms may indicate a greater tendency to perseverate on eating, weight, and shape, which may predispose an individual to binge in order to escape negative affect, and then subsequently compensate for the binge. This findings support prior research showing that individuals who engaging in binge eating and purging show greater shape and weight concerns (Grilo et al., 2009) and poorer prognosis (Fairburn, Cooper, Doll, Norman, & O’Connor, 2000) than individuals who endorse only binge eating. Conversely, an alternative explanation for the present findings is that the presence of both types of symptoms may prompt more frequent rumination about the disordered eating.
Results indicated that general tendency to ruminate (i.e., not solely on ED-related themes) did not distinguish between symptom groups. This result may indicate that individuals endorsing ED symptoms exhibit higher levels of rumination, but within the ED symptom groups, more specific, ED-related rumination is a more important distinguishing variable. Furthermore, positive beliefs about rumination were also not found to distinguish between symptom groups, indicating that all subgroups of individuals with bulimic symptoms have similarly elevated levels of positive beliefs about rumination.

**Limitations**

There are limitations related to the sample used in the present study that should be considered. The study was conducted using a sample of undergraduates, which limits the generalizability of these results to other populations in terms of age, ethnic composition, and educational and socioeconomic background. The data are cross-sectional in nature, therefore we cannot establish temporal sequence or infer directionality of these relationships.

Furthermore, the scale we used to measure positive beliefs about rumination (PBARS) has been shown to be confounded by mood state in some samples (Watkins & Moulds, 2005), such that individuals with a more depressed current mood tend to engage in more rumination and hold more positive beliefs about the helpfulness of rumination as a coping strategy. The present study did not control for mood or depressive symptoms, nor can we rule out the effects of other extraneous variables on the results of our analyses. It is possible that the retrospective nature of the present study failed to detect the relations between rumination and disordered eating symptoms as they occur in “real time.” Methods with greater ecological validity (e.g., ecological momentary assessment) would be more sensitive to fluctuations in ruminative processes that directly precede or follow specific symptoms, such as binge eating or purging.
Future Directions

Future investigations should examine the relationships between different features of rumination and disordered eating longitudinally. There is evidence that the relationship between ruminative coping and eating disorder symptoms in females is reciprocal over time in adolescence (Nolen-Hoeksema et al., 2007), however further study is warranted. Additionally, ecological momentary assessment data may facilitate an increased understanding of the way rumination and disordered eating symptoms relate in a natural setting, day-to-day.

A large quantity of research has shown distinct gender differences in tendency to ruminate, beginning at onset of puberty, and continuing into adulthood, such that females are significantly more likely to engage in rumination as a coping strategy (Broderick, 1998; Nolen-Hoeksema, 2001). Similarly, eating disorders have significantly higher prevalence rates in females than in males (e.g., Hoek & van Hoeken, 2003). As such, it may be useful to examine these relationships within each gender. The present sample size was inadequate to further separate the groups by gender.

The scope of the present study was to examine these facets of rumination within different subgroups of bulimic symptoms. Future work may expand upon this by exploring how symptoms of both BN and AN differentially relate to rumination and metacognitive beliefs. Furthermore, the present study only examined positive metacognitive beliefs about rumination, however there is evidence that negative beliefs about rumination may also be linked to disordered eating (e.g., beliefs about the uncontrollability of one’s thoughts; Cooper, Todd, & Wells, 2009). Thus, exploration of how negative metacognitive beliefs about rumination are related to overall eating pathology as well as different symptom manifestations would be a worthwhile endeavor.
References


### Table 1

**Discriminant Analyses of Rumination Variables in Disordered Eating Symptoms**

<table>
<thead>
<tr>
<th>Function</th>
<th>Eigenvalue</th>
<th>Percent of variance</th>
<th>Canonical correlation</th>
<th>Wilk’s lambda</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.08</td>
<td>70.2</td>
<td>.27</td>
<td>.95</td>
<td>4.66</td>
<td>1</td>
<td>.004</td>
</tr>
<tr>
<td>2</td>
<td>.03</td>
<td>29.8</td>
<td>.18</td>
<td>.90</td>
<td>15.38</td>
<td>4</td>
<td>.031</td>
</tr>
</tbody>
</table>

**Note.** EDReflect is the Reflection subscale of the RRS-ED; EDBrood is the Brooding subscale of the RRS-ED; Ruminate is overall rumination tendency, measured by the RRS. PBARSS is a measure of positive beliefs about rumination.

b. This variable was not used in the stepwise analyses.

### Table 2

**Structure Matrix**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDReflect</td>
<td>-.14</td>
<td>.99</td>
</tr>
<tr>
<td>EDBrood</td>
<td>.67</td>
<td>.73</td>
</tr>
<tr>
<td>Ruminate$^b$</td>
<td>.23</td>
<td>.49</td>
</tr>
<tr>
<td>PBARSS$^b$</td>
<td>.13</td>
<td>.25</td>
</tr>
</tbody>
</table>

Note. EDReflect is the Reflection subscale of the RRS-ED; EDBrood is the Brooding subscale of the RRS-ED; Ruminate is overall rumination tendency, measured by the RRS. PBARSS is a measure of positive beliefs about rumination.
Figure 1

*Plots of Group Centroids on Two Discriminant Functions Derived from Four Rumination Variables*

- Purge-Only
- Binge & Purge
- Binge Only
- Group Centroids